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48.

# DISTANT GLIMPSES;

OR,

# ASTRONOMICAL SKETCHES.

BY FRANCES BARBARA BURTON.

"——— awful DARKNESS rends the veil of light,
And vast Creation—bursts upon the sight!
Man looks abroad, beyond mere noon day skies,
And vision, through ætherial mazes flies:
One blaze of glories, greets his raptured gaze,
And all Infinitude,—his SOUL surveys!"

*Manuscript Poems by Frances Barbara Burton.*

LONDON:
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CHANCERY LANE.
1837.

48.

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WITH
HUMBLE PROSTRATION OF
DEVOTIONAL FEELING THE LOWLY INCENSE
OF THIS ATTEMPT IS HAZARDED
IN FEEBLE ILLUSTRATION OF THE
IMMUTABLE POWER AND INEFFABLE GOODNESS
OF THE CREATOR.

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# PREFACE.

PHILOSOPHERS have ever regarded the contemplation of the celestial bodies as the highest privilege of their nature, and the sublimest exercise of their reason, affording as it does, the amplest demonstration within human faculties, both of the wisdom, goodness, and power of the universal Creator, and of man's relative station amidst His works.

Man, with only an earthly existence of four-score years, the major portion of which he passes surrounded by creatures of inferior classes, and enveloped in a maze of light bewildering to the senses and inflating to pride, man, might fondly imagine the little globe upon which, unconsciously to himself, he is whirling around his own Sun at the rate of 64,000 miles an hour, to be the universe, and himself, "Lord of all," did not the invaluable privilege of nocturnally looking beyond his "noonday skies," recall a sense of his comparative position in creation.

Incalculable by human apprehension, as are the benefits conferred through the influence of the Sun, those derived from the intervention of *darkness*, are no less important. DARKNESS, that sublimest of teachers, in unfolding the magnificence of the heavens, bids man, in their majesty, contemplate *that* of CREATIVE WISDOM; and, in the splendid abodes of beings, possessing natures so transcendant, that a year in their calculation, embraces a century of earthly ones; DARKNESS, benignly, but imperatively displays the *actual importance of his race* amidst infinitude; until soaring to the Creator through his works, man is enabled, rationally and gratefully, not wildly and presumptuously, to join even on Earth, in the great hymn of space.

Well, therefore, may the wise regard astronomical pursuits, as their noblest prerogative.

---

The following familiar observations on man's real position in the universe, are hazarded for the assistance of the juvenile enquirer. The improvement in telescopes and in the scientific observations of latter years, happily for the rising generation, sufficiently place astronomy within popular reach to preclude the necessity of employing the misguiding terms of former ages;—scientific terms are also avoided; as little as possible is said respecting this planet, (the Earth;) and nothing relative to the tides; it being the object of these remarks, not to give undue importance to the planet on which we live, and with whose phenomena we are familiar; but to expand juvenile attention towards those REGIONS OF SPACE wherein, systems are found crowning systems in countless profusion; and amidst whose VASTNESS, not merely this planet, the Earth, but our entire solar system, with all its stupendousness, forms but a *comparatively* INFINITESIMAL POINT.

# ADDRESS.

About three years since, the request of a respectable tradesman of hers, induced the authoress to enquire for an elementary work, explanatory, in popular terms, of the general system of surrounding luminaries. Their magnificence interested him, but occupation precluded study, and though naturally intelligent, this individual found himself involved in difficulty, by the *technical* terms usually employed in astronomical explanations.

To the authoress's surprise, she found herself engaged in a fruitless search;—every astronomical introduction submitted to her observation, presenting *technical* phrases, professing to illucidate, but in fact, offering the proscribed impediments to the uninitiated mind.

Her bookseller became weary of procuring treatise after treatise for her inspection; and one day he exclaimed, in a pet, "Indeed madam, there is no work of the kind, and if you *must* have one, you had best set about writing it *yourself*." "I really think I had," rejoined the authoress, and straightway repairing to her writing desk, she commenced throwing preliminaries together for the following POPULARLY EXPRESSED remarks.

She soon perceived the difficulty of describing, in *familiar language*, unassisted by any precursor, the complicated machinery of the celestial bodies; but the hope of ultimate utility towards some of her intelligent countrymen, sustained her through mental exertions, for which previously she should have held herself incompetent; and since the original developer of any system, however diligent, may in some minute instances, prove deficient, the authoress throws herself on the generosity of a British public, should any unessential inaccuracy occur in the following pages; pledging herself at the same time, for their general correctness.

In any case the disinterestedness of her zeal is apparent, from the price named for a work of so much labour; the authoress having directed her publisher to affix one within popular purchase. The strictest attention has been paid to avoid as much as possible *technical phrases:* although enthusiasm at the sublimity of her subject, namely, "*the manifestation of creative power and beneficence through astronomical facts,*" may have caused, during the labour of three years, occasional elevation of style. It is a subject, considered by Paley, of a nature *too vast** for minute demonstration to human faculties. Being cursorily treated in his beautiful Essay on Natural Theology, the authoress has endeavoured to render its general developement, the GROUND WORK of the present attempt in all the straightforward singleness of devotion, though with heart-bowed humbleness of spirit.

* Page, 378, Paley's Natural Theology.

# INTRODUCTION.

# INTRODUCTION.

## OF CELESTIAL BODIES, VISIBLE TO MAN.

THE celestial bodies visible to man may be separated into two divisions: namely,

### DIVISION THE FIRST.

CELESTIAL BODIES COMPARATIVELY NEAR MAN'S ACTUAL POSITION IN SPACE.

### DIVISION THE SECOND.

CELESTIAL BODIES COMPARATIVELY REMOTE FROM MAN'S ACTUAL POSITION IN SPACE.

The first division comprises what is called the "solar system;"—the componant bodies of which, may be separated into four classes: namely,

1st Class.—*That star nearest to Man's vision called* "THE SUN." The source of life, light, and heat to all within his influence, and which is placed in the centre of our solar system.

2nd Class.—*Eleven bodies called Primary Planets.* Each of these primary planets revolves round the Sun in a specific portion of time, and at a specific distance from him; the specific period of each planet's revolution augmenting, in proportion as the encrease of solar distance, by augmenting the *angular divergencies of solar impulses, diminishes their impetus.* All the primary planets receive the impulses of light, heat, and motion, from the Sun. The names of these primary planets, are, *Mercury*, *Venus*, *the Earth*, *Mars*, *Vesta Juno*, *Ceres*, *Pallas*, *Jupiter*, *Saturn*, and *Herschell.* The Earth (which we inhabit,) being the third in distance from the Sun.

3rd Class.—*Eighteen bodies called Secondary Planets or Moons.* Of these secondary planets, our own Moon is one. Each of these Moons revolves round its relative primary planet, amongst which they are distributed, in like manner as our own Moon revolves round our own planet, (the Earth.) These eighteen Moons are distributed as follows:

| | | |
|---|---|---|
| The Earth | 1 Moon, | or secondary planets. |
| Jupiter..... | 4 Moons, | |
| Saturn...... | 7 Moons, | |
| Herschell.. | 6 Moons, | |
| | 18 | |

4th Class.—*Bodies called Comets.* These, like the eleven primary planets, revolve round the Sun, but in more eccentric courses. Their number is unknown.

---

## GENERAL OBSERVATIONS ON THE PLANETARY BODIES APPERTAINING TO OUR SOLAR SYSTEM.

## ON PRIMARY PLANETS.

ALL planets, whether primary or secondary, are opaque bodies, shining by the light they receive from the Sun.

All the primary planets, move in space round the Sun from west to east; and each of them, in its own specific course. These courses, are called their "Orbits." Attention should here be directed to the following remarks on planetary motion.

1st.—Planetary orbits (or courses round the Sun) are not precisely circular, but in form incline to elliptical (or *oval)*, the Sun being situated beyond the centre, or towards one end, of that oval.

2nd.—The portion of time employed by each planet in revolving round the Sun, is determined by the relative vicinity, or remoteness towards the Sun, of its orbit. The nearest planet (Mercury) being actuated by the strongest solar impetus,* travels round the Sun with the greatest rapidity,—and each of the other planets, accomplishes its course round him in a period, minutely proportioned§ to the augmentation of *the relative distance of its orbit from the sun*,—and to the consequent diminution in force of the solar impetus upon that planet's orbicular motion, (as will be further adverted to, in treating of the Sun.) Hence, Mercury, the nearest to the Sun, is found to be the most rapid, and Herschel, the most remote from the Sun, the slowest planet appertaining to our solar system.

---

* Impetus.—The sun's propelling impulse.

§ Science is indebted to the immortal Kepler for the discovery of this law of planetary *proportionate velocity*: a discovery ranking amongst the proudest instances of human intelligence; proving as it does, that, in the mechanism of our solar system, (to use Kepler's scientific words), "the forces at different distances, are inversely as the squares of those distances, and directly as the quantity of matter in the agent."—In other words, that with all the planets, "the squares of the time of their revolutions, are in the proportion of the cubes of their mean distances from the Sun." In popular phraseology, that the greater the distance of any planet from the Sun, the more diminished will be the force of solar impetus upon that planet's orbicular motion: consequently, the slower will be that planet's annual motion.

3rd.—In consequence of the proportionate augmentation of solar impetus on solar approximation (how minute so ever *that* approximating variation), every planet moves fastest in that portion of its annual course, which carries it nearest the Sun: that is, in that portion of it carrying the planet round the nearest end of its oval orbit to the Sun; and necessarily, every planet moves the slowest, in traversing the opposite, or remotest oval end, from the Sun.

4th.—The respective portions of time employed by each primary planet in one revolution round the Sun, forms that planet's year,—or what is called "*its annual course.*"

5th.—All the primary planets, while revolving round the Sun, turn likewise round their individual selves. This last motion is called, "*turning on their axes.*" As one revolution round the Sun constitutes the year, so one rotation round itself, constitutes the day and night, of each individual planet; as we experience, in our own particular one, the Earth.

6th.—For the illustration of science, every planet is supposed divided into *two equal portions* by a line of its circumference, called the *equator*,[*] which line is subdivided into 360 equal parts, or degrees.[‡] That is, each planet is supposed divided by its equator, (or equatorial line,) into two portions, whereof *each* comprises a distance of 90 degrees from every part of that equatorial line, towards each of that planet's two poles.[†]

7th.—Planets do not travel round the Sun with their poles perpendicular to their path in the celestial ecliptic: the inclination of the poles of each planet towards it being proportionably greater, the nearer is the planet to the Sun.

8th.—In consequence of this inclined position, the line around each planet turned towards the ecliptic, as the planet revolves round the Sun, crosses the planet's equator *twice* in each revolution—once in ascending towards it from the South, and again at the opposite point, in descending towards it from the north. A planet's course is ascertained by the greatest number of degrees on either side of its equator, to which this line diverges. These divergencies always coincide.

---

[*] The Equator is an imaginary line around the circumference of any globe, equally distant from each of its poles.

[‡] Degree—A celestial degree is the 360th portion of the celestial ecliptic.

[†] Poles, are the extreme parts of any globe, and the axis round which it turns.

9th.—The precision of this line demonstrates the relative temperature of every planet—its diverging distances from the equatorial line of any planet being found to diminish in proportion to the increase of distance of that planet from the Sun. Thus, farther on, we shall find it on Mercury, diverging towards the very poles, or nearly 90 degrees from the equator;—on Saturn, only diverging 2½ degrees on either side from the equator;—and on the Earth, placed as she is, in a medium between both, diverging 23½ degrees on each side of our own particular equatorial line.

That all the other magnificent planets, equally obeying the laws of motion, and thereby equally participating in the same beautiful alternation of day and night, heat and cold, which crowns the Earth with blessings, should not, like it, be inhabited; consequently, that orbs, in some instances, immensely superior in magnitude, and created with attendant apparatuses infinitely more intricate than that belonging to the Earth: that such mighty orbs should be mere *blanks in creation*, is inconsistent with the fecundity everywhere observable on our globe.

Lest a doubt on this subject should arise in the uninstructed mind, let it be remarked that atmosphere encircling a celestial body, wheresoever descried, plainly indicates the presence of land and water, and of mechanism adequate to the transmission of heat, light, and sound. In a word, of whatsoever may be necessary, not only for the production and preservation of vegetable and animal life, but for the accommodation of specifically intelligent and intellectual agents. The presence of all these essentials to existence and happiness, has been already clearly ascertained on six out of the eleven primary planets, through the evidence of atmospheres, visibly encompassing their respective orbs, and visibly supporting their respective clouds. The other five planets, are either too distant, or too recently discovered, to speak of them with equal present precision: but probably, no very remote period may afford astronomers demonstration of their corresponding vitality.

## ON SECONDARY PLANETS OR MOONS.

ALL secondary Planets, or Moons, revolve from west to east round their respective primary planet, (except those of Herschel, which shall be duly adverted upon) in like manner, as our own Moon revolves round our own planet, (the Earth). The orbits of most of them, are nearly circular, though inclining to oval; and in several instances, their primary planet is stationed towards one end of that oval. The diameter of these orbits, is regulated by the respective distances of each Moon from its primary. Each Moon turns round itself, at the same time that it revolves round its primary planet. One rotation round itself, constitutes the day and night of each Moon, but the length of each Moon's year, is the same as that of its primary.

The following cursory observations are offered respecting divers of the celestial bodies included within the foregoing two grand divisions of them prefixed to the introduction.

# DISTANT GLIMPSES.

# DISTANT GLIMPSES.

## DIVISION THE FIRST.

### CELESTIAL BODIES COMPARATIVELY APPROACHED NEAR MAN'S ACTUAL POSITION IN SPACE, AND COMPRISED WITHIN THE SOLAR SYSTEM.

## CLASS THE FIRST.

### THAT STAR NEAREST MAN'S VISION, CALLED,

## THE SUN.

THAT particular star, in the regions of space, around which, the Earth, and the other ten primary planets of our own particular solar system revolve, is the globe we denominate "THE SUN."

This effulgent luminary, forms the centre of our planetary system; and appears to us, infinitely larger and brighter, than any other of the stars; a delusion, originating in the vicinity of the path this planet (the Earth) holds around this particular star, in comparison with the immense distance of that path from all the other stars. A spectator placed as near *any other star*, as we are to that called the Sun, would behold in *that star*, a body equally large and bright, as the Sun appears to us; and from that position, our Sun, *divested of all his circumvolving planets*, would seem no larger, than *that particular star appears to us.*

Yet such is the magnitude of the *distances of space*, that, comparatively near as is the Earth to the Sun, that luminary is, nevertheless, 95 millions of miles distant from the Earth: a distance so vast, that eight minutes are required for light to traverse it, in coming from the Sun to the Earth; and which it would take a cannon ball 22 years to accomplish, from the Earth to the Sun. The figure of this stupendous orb, the Sun, is a spheroid; that is, an oval globe, whereof the equatorial diameter, is larger than that of the poles. His solid bulk is calculated to be more than a million times greater than that of the Earth; and his diameter, to comprise 804 thousand miles.

Unreflecting man is apt to view in the Sun, an orb of limited dimensions, conveying light and heat by the daily performance of a circuit, that causes him to rise towards the east, and sink towards the west. Less attentive to *his* operations, than is a child to the movements of his ball, he must generally resort to an almanack, to learn the hours, or periods, of his particular influences; and yet, to the instrumentallity of this mighty agent of creative power it is, that the *whole animation* of our entire planetary system, stands indebted! *This it is*, which expands the air, melts polar ice, conveys warmth to the ground, endows vegetation with luxuriance, flowers with brilliancy, fruits with ripeness, and the whole animal creation with life, joy, and plenteousness. The grand reservoir of nature's treasures, it is within the sacred GLOBE OF THE SUN, that are concentrated all the physical combinations of substances,—the origin of their attractions, —their movements,—their generations,—their duration,—with all the irresistible, but unknown sources, of the phenomena attendant on electricity, magnetism, the inclination and declination of the needle, &c. To convey to human faculties, a faint illustration of the magnificence of this orb, the following passage shall be quoted from the works of Sir John Herschell.—"The average distance of the Moon's centre from that of the Earth, is about 237,000 miles. This distance, great as it is, is little more than one fourth of the diameter of the Sun's body; so that the globe of the Sun, would nearly twice include the whole orbit of the Moon; a consideration, wonderfully calculated to raise our ideas of that stupendous luminary."

The next object requiring attention, is the agency of the Sun's planetary operation;—whereby one cycle after another, he *propels the individual motions of his dependant planets.*

From minute astronomical observation, the Sun is ascertained to revolve on his axis, in a period of

25 of our earthly days, 80 degrees 40 minutes from the plane of the ecliptic.

Let human intellect imagine a globe, two million four hundred and twelve thousand miles in circumference, in the rapid revolution around itself, of *four thousand miles an hour.* What must *not* be the impetus, of a like rotation! But, let imagination further aim at figuring to itself, the *entire surface* of this globe, pouring forth *torrents of vitalic affluxes* throughout its planetary system; and sinking beneath the magnitude even of its own feeble imagery, adoration of CREATIVE MAJESTY, must be its refuge.

To attain a faint conception of this celestial machinery we must remember, that separately propelled torrents, each of them composed of less than infinitesimal atoms, are ceaselessly emanating, at less than infinitesimal distances from each other, throughout every portion of the Sun's disc,—and *that*, with a velocity, that blends the infinity of their affluxes, into a *concentrative blaze, two million four hundred and twelve thousand miles, in circumference!* A velocity, carrying likewise each specific torrent, from the very commencement of its propelling angle of infinitesimal divergence, athwart a space, of more than *two billion miles*—the relative angular divergences of *each*, necessarily augmenting, in proportion as it progresses from the Sun's circumference, towards the limits of his entire system. What an apparatus!! A globular affluxial blaze, more than TWO BILLION SQUARE

MILES IN SURFACE,—scattering itself forth in every direction—*billions of miles !!!* But still, an apparatus of mere pageantry, were the globe of the Sun a FIXTURE *in space.* But behold, each affluxial torrent, while in straightforward impulse, behold it from its commencement, circulating at the rate of four thousand miles an hour, in an eastwardly direction, through the *rotation around himself, of its fountain,* the SUN,—thence ALL becoming transformed, *through the specific distances of their intersectional angles,* from mere emanatory appendages, into propelling mediums around *himself,* of rejoicing worlds. For *here we must observe,* that the same invariability of angular divergence, and the same propelling velocity that actuates one affluxial torrent, *governs them all,* from whatsoever portion of solar disc propelled. In consequence of the *rotatory action of the Sun upon them all,* each affluxial torrent, in its progress towards the confines of our system, must necessarily therefore, find itself perpetually *crossing,* or *being crossed by,* myriads of correspondently diverging emanations ; and hence, from the rotation of the Sun on his axis, a *systematically infinitesimal intersection* amongst these affluxes takes place throughout the whole solar system, all pervading from velocity, all sustaining from intersectional minuteness ; but whose *component angular divergencies,* be it remarked, *proportionably augment,* with the augmentation of their distances from the Sun.

Thus, by the operation of the Sun's rotation, the angular intersections of these *primarily* diverging torrents, become, at specific distances from him, propelling agents of motion around himself to abodes of joy and vitality, with the undeviating precision appertaining to a mechanism of infinitesimal minuteness; and thus it is apparent, that the nearer to the Sun's disc these intersectional crossings take place, the more minute among themselves, must be the angles of divergence. Consequently, the nearer a world, or planet, is placed to the Sun, the more forcibly, and therefore the more rapidly, it will be propelled around him; and, on the contrary, the more remotely a world, or planet, is placed from the Sun, the wider must be the angles of intersectional divergence at *that* solar distance, and the less powerfully, and therefore, the slower it will be propelled around him; the motion of each specific world around its Sun, being undeviatingly relative to, and regulated by, *that world's proportional solar distance*:—as is beautifully demonstrated by the great Kepler's law of distances, heretofore quoted.

The youthful enquirer will please to wait till near the close, of these remarks, for an attempt at illustrating the agency of the solar rotatory principle. What may be the *chemical properties*, to use human phraseology, of its infinitesimal affluxes seem above human apprehension. Acting as they do beyond our solar system, as well as upon every other planet within it, and the materials of each planet apparently being differently combined, or essentially differing from those of every other planet, the specific properties of these infinitesimal affluxes must posssess an UNIVERSALLITY OF CHARACTER, not entering the restricted conception of inhabitants of *any single planet.*

The powerful telescopes of Sir William Herschell disclosed the following important facts: namely, that the luminous, undulating atmosphere of the Sun extends nearly 6,000 leagues in height; and that this atmosphere has partial occasional openings, that allow portions of the Sun's *actual disc*, or surface, to be perceived by the philosophic enquirer. These openings are popularly, but misguidingly called, "Spots on the Sun;"* but, are not extraneous substances, or foamy surfaces, but the *summits of actual mountains.* Sir W. Herschell, whose mighty discoveries acquired him the appellation of "the Columbus of astronomers," repeated these observations so frequently, that no doubt remained with him, "that the Sun is an immensely large lucid planet, evidently the primary one of our system; all the others being, *in fact, secondary* to it." From its similarity to all other planets, in regard to its solidity, atmosphere, diversified surface, rotation round its axis, the fall of bodies upon its surface, &c. he came to the conclusion, that like them, this *august orb is inhabited:* and in this intelligent age, when optical instruments have attained sufficient excellence to exhibit, within every drop of water, the existence of 100,000 organized creatures, it has become absurd to imagine, a globe, larger than all the other planets taken together, to be void of inhabitants.

---

* The diameters of some spots are upwards of 45,000 miles.

The Sun, being the source of light and motion, how luxuriant, how resplendent, how superlative, must be all his productions! With valleys, of limits lost amidst horizons, a hundred-fold exceeding ours in expansion, and with Alps carrying summits, not into the frozen temperatures of our earthly mountains, but, into the very bosom of *that* atmosphere, *whence flows the vitality of surrounding worlds.* What of earth-born beauty can emulate a grandeur thus awfully majestic! How glorious must be the intellectual faculties of *Beings* FITTED *for such an abode!*—an abode around which our entire planetary system lies extended, in its fulness of harmonious perfection; and whence, the individual course of each respective planet may be traced, from its remotest aphelion,* to its closest perihelion,† in the complete developement of Omniscient Wisdom!

It is from minute observations on the rotatory movements of the *dark solar spots,* by powerful glasses, that science has already ascertained the period in which the Sun turns on his axis, to be 25 of our days. The determination of *that* of his course around the common centre of the universe, or even of his revolution amidst his own *particular cluster of suns,* remains for the illustration of very

* Aphelion, that point of a planet's orbit the remotest from the Sun.

† Perihelion, that point of a planet's orbit the nearest to the Sun.

remote generations, (as will be adverted upon further on). Suffice it in this place to observe, that although the stars *maintain their relative positions among their mighty selves*, yet that they are evidently progressing together, in *stupendous common motion!*

Here finite conception staggers beneath the contemplation of infinitude! Myriads of ages may be requisite for mere human faculties distinctly to ascertain *the term of the* CELESTIAL YEAR! that is, to calculate the many thousands of years, necessary for that *particular star* we denominate "our Sun," in magnificent fellowship with the countless hosts of all the other Suns, we denominate stars,—*each individual of these luminaries* being accompanied like our own Sun, by *his particular and entire system of planets and their attendant Moons*, for *this magnificent fellowship of countless hosts*,—to accomplish ONE SACRED COURSE AROUND THE AWFUL CENTRE OF THE UNIVERSE.

Here we must pause! master minds alone can sustain like meditations.

# SECOND CLASS.

## THE ELEVEN PRIMARY PLANETS.

### FIRST PLANET.

# MERCURY.

MERCURY is the planet supposed to be nearest to our Sun. Mercury revolves round him in 88 days, which form the length of his year. The velocity of Mercury's motion in this, his circuit round our Sun, is at the prodigous rate of one hundred thousand miles an hour! Mercury is one of the smallest of the primary planets, and being only about 36 or 37 millions of miles distant from the Sun, is rarely seen by the inhabitants of the Earth, lost as he is generally, amidst solar effulgence.

Mercury* is consequently situated in such vicinity to the orb of the Sun, that, were he created in exact organic conformity with the Earth, he would experience, as a planet, a degree of light and heat seven times stronger than that of the Earth; and a piece of iron, which would remain cool on the surface of this planet, would become *red-hot* on that of Mercury. The inhabitants of Mercury therefore, must either be indestructible by fire, consequently, be formed of materials differing from ours, or some essential difference in the mechanism of Mercury, *as a planet*, must induce mitigation of heat. The last evidently appears to be the fact, since, although rarely visible, philosophical perseverance has ascertained by powerful glasses, not merely the existence of surrounding atmosphere, but of some of the particulars in the construction of Mercury whereby the mitigation of heat requisite for his position is obtained.

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* "The intensity of solar radiation is nearly seven times *greater* on Mercury than on the Earth;—and on Uranus (Herschell) 330 times *less*:—the proportion between the two extremes being that of upwards 2000 to one. Let any one figure to himself the condition of our Globe, were the Sun to be septuple—or were it diminished to a 330th of its actual power."—*Sir John Herschell's Treatise on Astronomy.*

In the first place, Mercury's *poles* are singularly flat; and his equator is encompassed by a chain of mountains, surpassing in height any of those in the Earth. These equatorial regions are crowned with perpetual ice, and cause a peculiar brilliancy in Mercury, as a planet, from the resplendence of their summits. Hence the refreshment to Mercury's inhabitants occasioned by winds blowing over icy ridges and less elevated tracts of melting snow and ice,—a refreshment everywhere abounding, the whole surface of this planet exhibiting elevations stupendous in height:—elevations calculated at once for shade and coolness, and necessarily productive of the most luxurious and diversified vegetation. In fact, were conjecture permitted on such subjects, we should presume that the productions of Mercury must exhibit the finest possible assemblage of beauty and magnificence:—remarkable inequality of surface compensating, in diversity of temperature, for the smallness of this planet's magnitude.

In the second place, Mercury is found, in his annual course round the Sun, to incline the plane* of his orbit 90 degrees on his equator; thus rendering his poles, in counterdistinction to those of our Globe, his most temperate and salubrious parts, refreshed as they are by the periodical snow and ice, melting of his equatorial mountains;—that stupendous but benignant icy zone, which divides the surface of this, otherwise scorching, planet into two delightful hemispheres!

In the third place, the rotation of Mercury on his axis, comprises nearly, if not quite, the length of his year. Thus, through long absence from solar beams one or other hemisphere is alternately acquiring freshness and coolness; while the splendours of the neighbouring planets, of Venus and the Earth, with the Moon of the last, during these alternate long nights, must afford ample provision for comfort and enjoyment. Probably, the magnificent products of our Indies might sink into insignificance, compared to the riches of a planet imbibing, like Mercury, the potent influence of solar rays thus benignantly mitigated. Vegetable, mineral, and animal productions, profiting by their light and warmth for six weeks, in alternate succession, must attain a perfection only excelled by those within the mighty orb of the Sun himself.

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* "Plane of his orbit."—Line on the surface of any planet on which it turns on its axis.

## SECOND PLANET.

# VENUS.

VENUS is the second planet from the Sun, and her distance from him is 69 millions of miles.—Venus is rather smaller than the Earth in bulk, although much larger than Mercury, and she revolves round the Sun in about 235 of our earthly days, travelling round him at the rate of 70,000 *miles an hour*. The latest observations have determined the rotation on her axis to be performed in 23 days.

Nothing expands human faculties like contemplating the *various methods* employed by the Creator for accomplishing, under diversified circumstances, the same benignant end, whatsoever may be *that specific end*. In the present instance, the *end* to be accomplished consists in the production of the greatest possible comfort for the inhabitants of each individual planet; and this end could solely be obtained by the adaptation of each planet's construction to its proportionate distance from the Sun. The higher the excellence of telescopes, and the profounder the science of future generations, the more minutely the astronomical observations on each individual globe, will develope the accomplishment of this Almighty purpose.

Let it be here remarked, that it is only 227 years since the existence of Jupiter's four Moons *was suspected;* the laws of whose motions are now as accurately ascertained as are those of our own Moon. What a stride in knowledge, even in *this* (comparatively with future generations) infantine age of astronomical observations, has not the invention of telescopes already achieved! Already have telescopes demonstrated, that notwithstanding the solar planets are governed, generally, by the same laws, yet, that no two of them are formed *specifically alike*,—each of them being fashioned with an express adaptation to the comfort of its own particular position. It is an assemblage of orbs, thus diversified in construction, *for express unity of purpose* within one common system, which constitutes the CRITERION OF OMNIPOTENCE! An Almighty harmoniousness of design, the investigation of which constitutes the noblest privilege and most expanding exercise of man's faculties.

We have turned attention to one marked feature in the construction of Mercury, namely, the singular flatness of his poles, in mitigation of the heat consequent to his vicinity to the Sun. Nature is never prodigal of expedients—she always thoroughly accomplishes her intention—never strays beyond them. Venus, not being so closely approximated to the Sun, equal polar flatness was not requisite, and this peculiarity is not observable in her.

Amongst various proportional mitigations of heat, the most remarkable are,—first, the inclination of Venus's rotation on her axis, of full 72 degrees on her equator. This inclination obtains a torrid zone of considerable breadth, and induces great obliquity of solar rays upon it.—Secondly, the intervention of an atmosphere of excessive density.—And Thirdly, a night of 23 days in length. Consequently, a general mitigation of heat must prevail throughout the planet, the inhabitants of its poles enjoying a temperature as mild as that of ours in spring.

Like those of Mercury, the mountains of Venus are stupendous, but are more generally dispersed than in him. Some of Venus's mountains have been calculated at nine miles of perpendicular altitude. Throughout her surface immense elevations everywhere abound interspersed with large masses of water. Hence, the splendid brilliancy of Venus amidst the heavens, crowned with ice and snow, as must be the stupendous summits of mountains far surpassing in altitude the loftiest of the Cordilleras ! What a profusion—what an endless variety of vegetation must be enjoyed throughout a surface of such multiplied diversity !—a diversity including the rarest productions of every possible soil, climate, and temperature.

Thus, amidst the splendour of a noon-day in Venus, the same minute attention to the welfare of his creatures is to be traced, which flattened, in a manner so demonstrative of *Superintending Wisdom*, the poles of a still hotter planet,—Mercury;—while during her nights, the brilliancy of Mercury, through his vicinity, and the majestic spectacle of the Earth beaming with radiance, and glorious in magnitude, as the Earth must appear with its resplendent Moon, more than compensate to Venus the want of an exclusive satellite.

Venus's course round the Sun lying within that of the Earth, she exhibits to us *two distinct series of phases** (like those of our Moon) between the moment of our first beholding her as a crescent, westward of the Sun at dawn, and that of her disappearing in a circular form in an evening, eighteen months afterwards, lost to us as she then becomes for some weeks, amidst the solar beams of her closer circuit round the Sun. When we thus behold Venus at dawn, at the commencement of one of these two series of phases, it is the consequence of our eastern horizon not having attained sufficient diurnal elevation to behold the Sun, although it has already arrived within sight of Venus, placed *as she is* 30 millions of miles nearer to us, in space, than is the Sun;—and in like manner, it is equally the Earth's nearer vicinity to Venus than to the Sun which causes *her* to be seen by us as an "evening star," for some time subsequently to our eastern horizon having descended out of sight of him.†

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* Phases.—Changes of apparent form.

† It cannot be too strongly impressed on the mind, that the spectacle of the celestial bodies is obtained, not from their rising above, or descending below, the Earth's horizon; but from the actual *daily*

In consequence of the varying relative positions of the two planets—Venus and the Earth—towards each other, nine months are requisite for the accomplishment of each alternate series of phases,—which is endeavoured to be explained as follows:

As Venus performs her course round the Sun in 235 days, if the Earth *stood still*, each series of Venus's phases would be seen from the Earth in about the *period of* 112 *days*, more or less. But, during the time Venus is travelling round the Sun, so likewise is the Earth,—and *that* in an orbit nearly 30 millions of miles more remote from him than is the orbit of Venus. Venus's course being thus *relatively smaller*, and more *rapidly performed* than the Earth's,—546 days—or 18 months,—are necessary for the entire development of both series of phases;—that is, a period comprising, *within* 76 *days*, *two of Venus's complete revolutions round the Sun*:—because, from the relative ratio of their respective courses, during the period of the 546 days, or 18 months, between our beholding her as first emerged from morning solar rays to her ultimate evening re-emersion within them, Venus must have actually passed between the Earth's course and the Sun's orb, skreened from our perception by his rays during this, her intervening passage.

Hence her alternate disappearances, as before mentioned, amidst solar beams,—and that some-

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*rotation of the Earth's planet* which causes the eastern horizon "to ascend *within* sight"—or "to descend *out* of sight of" them all.

times in a crescent, and sometimes in a circular form :—since, when Venus disappears by *passing between* the Sun and us, she becomes gradually lost in an augmenting *crescent* form; —but when in her solar revolution, Venus becomes lost amidst solar rays, by passing on the *opposite side of the Sun from us*, she then disappears to our vision, with the entire circle of her orb towards us :—and as she is nearly 60 millions of miles nearer to us when thus about disappearing in *a crescent* form, (namely, by passing between the Earth and the Sun), than when she is about so doing, by progressing on the opposite side of that luminary, Venus necessarily appears much larger in the crescent form than in the circular one.

The phases of Venus, therefore, bear a different character to those of our Moon,—(to be noticed further on). In Venus, they merely result from the relative angles in which the respective orbits of two independent planets,—the Earth and Venus,—place Venus before our observation :—with those of the Moon, on the contrary, they are dependant on the actual revolution of the Moon around this planet—the Earth.*

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* Regret must be here expressed at the retention, in popular works, of the terms "*retrograde*" and "*stationary,*" as applied to the relative motions of planets;—the former conveying the idea, *to the uninitiated,* of a backward, and the latter, of no motion in a planet :—whereas, it cannot too strongly be impressed on the mind, that it is the *undeviating precision of planetary motion,* that rests the stability of the Solar System :—the velocity of every planet being such, that, if impeded, the planet's destruction must ensue.

During the intervals between Venus's disappearance in an evening, and reappearance in a morning, she is occasionally seen moving across the Sun's disc like a small black spot. This phenomenon is called, "a transit of Venus." It very rarely occurs, being only produced when her course lies directly between our own planet—the Earth—and the Sun.

## THIRD PLANET.

# THE EARTH.

THE EARTH,—the planet we inhabit,—is next in vicinity to the Sun, revolving round him, at the mean distance of 95 millions of miles, in little more than 365 days. The velocity of this (the Earth's) course round the Sun,—although little more than half that of Mercury's, is at the rate of 64 thousand miles an hour :—a rate twenty times swifter than that of a cannon ball.

The diameter of the Earth is 8,000 miles. She turns on her axis from west to east every 24 hours at an inclination of 66 and half degrees on her equator. This rotation, causes our alternation of day and night; the hemisphere, which for the time is next the Sun, of course reflecting his rays, and enjoying daylight; and the opposite hemisphere, or the one on the contrary side of our globe, being for the like period, involved in darkness.

The rotundity of the Earth's form, may be proved, not merely from her having been sailed round, but from her shadow, during an eclipse, always falling upon the Moon in a circular figure, from whatsoever position projected; and likewise, because when two ships meet at sea, the top of the masts of each, is the part first mutually discerned, their lower portions being hid by the convexity of the globe rising between them. They resemble in this particular two men approaching from opposite sides of a hill; their heads first being visible to each other, and as they keep ascending, their figures gradually increasing in stature until they are beheld entire.

Besides these 64 thousand miles an hour, of the annual course round the Sun, a course which occasions the alternations of the winter and summer of the Earth's year, and the velocity, of which is common to all parts of this planet, besides these, the Earth's rotation on her axis, causes another revolution to all her inhabitants, varying to them in relative rapidity, according to their specific position on her surface. This variation in speed, is caused by the diameter of the Earth's equator having a larger circuit to perform than any other portion of her globe, in her rotation on her axis. The inhabitants of the equatorial regions are therefore carried along at the rate of 1,042 miles an hour, while those in the parallel of London, only travel 550 miles in that period.

These two motions of our planet being common to all bodies on her surface, and also to the fluids upon, and surrounding it, the combination of their relative motions produces the same impression on the senses, as though the planet were at rest:—

nevertheless, it is the actual rotation of the Earth on her axis from west to east, which causes the appearance of motion in the Sun and all the heavenly bodies, from east to west.

Carried along with a velocity common to every thing around him, an inhabitant of the Earth, is in the state of a spectator in a ship in motion, every thing on board, remains in repose, and it is the shore, the hills, and every surrounding object, that seems to move; until on comparing the extent of the shore, hills, plains, &c. with the smallness of the vessel, he recognizes, in the apparent motion of these large objects, the actual movement of himself in the ship. The countless stars of the celestial regions, are relatively to the Earth, what these hills and shores are to the vessel:—and unassisted by astronomy, the same arguments that convinced the navigator of the movement of his ship, might persuade the careful enquirer of that of the Earth;—but it is only since the motions of this *globe as a planet*, have been scientifically and astronomically demonstrated, that man has unequivocally recognized his position in the universe.

The present observations being intentionally limited to considerations on *our globe*, *as among the primary solar planets*, all allusion is avoided to the phenomena exhibited in our mineral, vegetable, and animal kingdoms, as well as to those attendant on the mechanism of our atmosphere, magnetism, tides, &c.;—phenomena, which cannot too diligently be studied in the many scientific works intended for their illustration, crowning with blessings as do their mighty wonders, the inhabitants of this glorious planet, and demonstrating the minuteness of the Creator's care over his Earth-born creatures.

We will advert, therefore, at once, to the most tremendous of all the Earth's rotations:—namely, the awful revolutions of the Earth's *perihelion point*, —revolutions on which rest *the duration of any planet*, as an *abode of percipient natures;* (consequently, appertaining to them all, as such,) since, upon these revolutions depend the renovation of that *productive principle*, without which the entire solar system would, in time be deformed, through exhaustion, into mere lifeless desert globes, instead of the splendid worlds, now holding on the rejoicing courses of animation and plenteousness.

So stupendous are the laws regulating planetary systems, that each revolution of the Earth's perihelion point, embraces a period of 20,931 years!

Previous to commencing this detail, we must recall to our minds—First,—That the orbit of the Earth round the Sun, like that of all other planets, is not exactly circular, but inclining to oval; with the Sun at about one-third distance from one extremity of that oval: the Earth, consequently, being at one season of the year (the winter of our hemisphere) only 93 millions of miles distant from that luminary; and at the opposite portion of her course, (during the summer of our hemisphere), 97 millions of miles from him. Secondly,—That when the Earth is at the part of her course nearest the Sun, she is said to be in her *perihelion;* and when at her most remote, in her *aphelion.* Thirdly,—That the planes of the Earth's poles and orbit incline 23½ degrees to each other; the Earth turning once every 24 hours on her axis. Fourthly,—That the Earth, like all other celestial bodies, moves with accelerated velocity during her perihelion, and with much decreased velocity during her aphelion portion of annual course.

In this age, the Earth arrives at her perihelion on the last day of December; the Sun being then vertical over the 23rd degree of her southern hemisphere's declination. Through the combination of solar forces, this perihelion increase of motion necessarily causes a proportionate energy throughout the elements of air and water; accumulating a vast body of fluids towards that portion of the Earth nearest to, and most directly influenced by, the solar forces. The whole economy of the waters may indeed be regarded, during such period, as affected by increased reaction, whether they be considered as agents or patients. Hence it is, that in the present age, so immense a body of water accumulates around the south pole, leaving no very considerable surface of land throughout the whole southern hemisphere, and extending into the 30th degree of south latitude.

Were the Earth always to arrive at its perihehelion point on *the 30th of December*, the present effects would continue on the southern hemisphere, and that hemisphere would *always* retain its present excess of water, and the northern hemisphere its excess of land. But, if from any cause the perihelion point, which so potently influences the reception of these combined forces, should *vary its declination*, the necessary harmony of cause and effect requires that the body of waters should, likewise, vary *its* declination; and, as the northern hemisphere cannot contain the waters of the southern one, without overwhelming a large portion of its own land, an indundation necessarily must take place over it, *whensoever the perihelion point moves from the southern to the northern hemisphere.*

By a suitable combination of solar forces, which has undergone the most scientific calculation, this phenomenon *is actually found to be accomplishing*, through the gradual revolution of the perihelion point. That is, the Earth is demonstrated not to arrive at her annual perihelion point by the yearly difference of *one minute and two seconds of a degree* of the ecliptic;* thereby making a difference of one degree and 48 minutes in the course of a century;—of a whole sign, in 1744 years;—of a quarter of a circle, in 5,233 years;—and of the whole ecliptic in 20,931 years!

In every 20,931 years, therefore, the same periods and phenomena are repeated from the recurrence of the same causes.

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* Ecliptic.—The circle in the heavens round which the planets move around our Sun.

Behold, here, stupendous cycles for progressive changes,—astounding in their results, but imperceptible in operation; each gradation of which comprises 5,233 years;—the opposite effects of which are only produced in 10,450 years;—and the respective phenomena of which, recur every 20,931 years.

It is calculated, that the present epoch of southern declination will continue, until the perihelion point arrives at 17 degrees and a half of southern declination:—that is, during the progress of the perihelion point through four complete signs, or 6,977 years, of which 4,070 years have expired;—and no considerable change is therefore to be expected from this cause, until about the year 4,719 of the Christian era.

Referring to the past, it is calculated, that the last grand relative change took place 5814 years ago; or 4,002 years before Christ,—the very date of the Mosaic account of the creation; and in all probability, producing such sensible phenomena as are described in the first chapter of Genesis:—and that in due progression, the middle southern declination was reached about the year 2,258,—producing, in all probability, such effects in *that* hemisphere, as may be imagined from the Mosaic and other accounts of the deluge, then taking place.

Referring to the *future*, the next time the perihelion point passes the equator, will be from south to north, in the year of the Christian era, 6,463; or 4,651 years hence;—a period so remote, that without any *physical convulsions*, the very name of Britain may be probably forgotten!

In the year 8,207, of our Christian era, the perihelion point will attain the *middle northern declination*, producing visible effects on this, our hemisphere. Between that period and 15,184, this *present* northern—(*then* the southern) hemisphere, with all its superb machinery of kingdoms, empires, and republics, will probably be as completely covered with sea, as is, at *present*, *the actual southern one:* that PRESENT southern hemisphere, which to the human race of that far distant period, will have become the NORTHERN hemisphere of this planet.

Thus, through the magnificent revolutions of the Earth's perihelion point, has the Creator beneficently ordained, the alternate gradual regeneration of her two hemispheres;—thereby maintaining, from one 20,000 years rotation to another, that vital principle of *planetary* "REPRODUCTIVENESS," —the stamp of Omnipotence throughout infinitude! By this unheeded, but unremitting operation, the present fathomless abysses of ocean are fructifying into the luxuriant valleys of far distant future ages, and its trackless deserts, into the majestic continents and fertile islands, of remote generations;—*destined* sites of the splendid states and empires, irradiating the NEXT HEMISPHERIC mutation.

Hence the durability of this globe, as a planet. Hence throughout cycles, incalculable by man, may the Earth hold on her course of fullnes and gladness, in ceaseless harmony with the countless other glorious worlds of an Omniscient Creator!

## FOURTH PLANET.

# MARS.

BEYOND the course of the Earth round the Sun, lies that of MARS;—his distance from the Sun being 140 millions of miles. Mars's diameter is computed to be 5,000 miles; his day and night are 39 minutes longer than ours; and the period of one of his years is nearly double that of one of ours. The velocity of his course round the Sun, is computed to be at the rate of 55,000 miles an hour.

In the two planets between the Sun and the Earth,—Mercury and Venus,—we have contemplated modes of mitigating solar *heat;*—we shall now attempt adverting to some, evidently intended to strengthen solar influences upon those planets, the orbits of which, lie beyond our own planet,—the Earth.

The first object of attention in Mars, is an atmosphere surrounding him of such immense altitude, that any star, on being eclipsed by him, does not recover its brightness, until Mars has passed over the distance of two of his own diameters from that star.

What a sublime spectacle of creative wisdom and power, is displayed in such an apparatus! An atmosphere, performing the specific functions of one mighty spherical lens, around a far distant planet! What an increase of light and heat must be condensed for the benefit of Mars's inhabitants, by solar influences thus collected.—And what a transcendent spectacle must this magnificent condensator develope, in the splendour with which it invests the Sun!—Beheld through an atmosphere of such intensity of refraction, the inhabitants of Mars must hail the appearance of the Sun before Mars's horizon has turned towards that luminary; and even after it has passed downwards from his rays; —and *that*, with an apparent diameter of immense magnitude.

Mars has no Moon; but the mechanism of such an atmosphere, together with the vicinity of the four small planets, Ceres, Pallas, Vesta, and Juno, with the glories of the resplendent planet Jupiter, must environ Mars with magnificence.

Mars turns on his axis at an inclination of nearly 61 degrees from his equator. Here we perceive a larger portion of torrid zone exposed to direct solar influence, than on the Earth's more temperate surface; Mars's poles being thereby elevated five degrees above those of the Earth, and *that* with an atmosphere of the refracting nature already mentioned.

With these advantages, each of Mars's poles must alternately behold the Sun throughout the space of one of our years;—consequently, notwithstanding remoteness from the Sun, each pole in turn, must derive heat sufficient during one of its long summers, to melt, periodically, the snow and ice of a whole earthly twelvemonth's winter.

Telescopes exhibit in Mars *variable dark belts*—the necessary indications of the meltings of vast snow and ice accumulations. These belts are objects of peculiar interest, marking, as they do, the returns of the seasons in their noble planet. The hemisphere crowned with the snow of one of his long winters, necessarily reflecting with increased brilliancy the solar rays; and the hemisphere upon which it has recently dissolved, resuming the dark fiery colour natural to the presumed ferruginous nature of Mars's soil.

From these very cursory allusions to the compensatory bounties displayed in the construction of Mars, it may be presumed, that although Mars's diameter is smaller than the Earth's, yet, in consequence of the singular refraction of his atmosphere, and of the elevation of his poles, Mars's general habitable surface may equal *in extent*, that of the Earth;—while his " seed times and harvest times" are found to fructuate and expand, with the regularity and luxuriance of our own blessed ones.*

Note.—On the 18th of February, 1837, the Moon becoming, during her passage across Mars, a focus to his rays, demonstrated through splendid reaction of solar beams the grandeur of Mars's atmosphere in an arch of variegated radiance stretching nearly from one horizon to another

### THE FIFTH, SIXTH, SEVENTH, AND EIGHTH PLANETS.

## VESTA, JUNO, CERES, AND PALLAS.

BETWEEN the orbits of Mars and Jupiter, are situated those of the four small planets, VESTA, JUNO, CERES, and PALLAS.—The recentness of the discoveries of these smaller planets, preclude specific remarks upon them, although the diversity already ascertained, both in their relative orbits and atmospheres, promises a future harvest for physiological investigation.

The atmosphere of Vesta is found rivalling that of our Moon in rarity, and those of Ceres and Pallas appear equally remarkable for density. The atmospere of Pallas is estimated at 465 miles, and that of Ceres at 668 in height.

In their course round the Sun, these four planets diverge further from the line of the celestial ecliptic than the larger ones.

The orbit of Vesta, especially, departs very considerably from it, and is supposed to cross those of the three others, viz.: Juno, Ceres, and Pallas.

*TABLE of the names and solar distances of the above planets and of the periods of their courses round the Sun.*

| Names of Planets. | Solar Distances. | | Period of Solar Revolutions. |
|---|---|---|---|
| | MILES. | | DAYS. |
| VESTA ...... | 225,000,000 | in | 1,335 |
| JUNO .... | 252,750,000 | in | 1,591 |
| CERES .... | 263,000,000 | in | 1,681½ |
| PALLAS...... | 263,000,000 | in | 1,682 |

## NINTH PLANET.

# JUPITER.

THE planet whose solar course lies next that of Pallas, is JUPITER.

Jupiter is the largest planet in our solar system: his diameter extending more than ninety thousand miles, and his bulk exceeding that of Venus in the the proportion of 1,500 to 1. Hence he is poetically described, "travelling with kingly pomp, the rival of the Sun." Jupiter's mean distance from the Sun is 493 millions of miles; and he performs his revolution round it, at the rate of 29,000 miles an hour, in the period of 11 years, 218 days, 14 hours, 27 minutes, and 10 seconds.—Consequently, a being born in Jupiter, and aged 15 years (according to the computation in that planet) must have nearly attained the age of 180 of our earthly years. If "knowledge is power," and if experience produces knowledge, what must not be the comparative intellectual superiority of Jupiter's inhabitants over those of our Earth?

In Mercury and Venus we attempted adverting to some of the creative plans of wisdom for the mitigation of heat.—Jupiter's course round the Sun, lying 349 millions of miles *beyond that of Mars*, a fresh scene opens before us of that Omniscient Sway which WILLS the welfare of its universe, and with *which*, to WILL, is to perform. In Jupiter, therefore, some of nature's mighty laws for the mitigation of *cold* claim our attention.

The first of the mitigatory laws to which we shall venture alluding, is the line of Jupiter's rotation on his axis. The further our observations carry us from the Sun, the closer we shall find *the inclination of the orbit of each planet, towards its equator, to be in progressive proportion to the increased remoteness of each individual planet, from the Sun.* This proportioned inclination, offers a striking exemplification of *compensatory care* towards the inhabitants of all.—First, because the narrower the torrid zone of any planet, (that is, the closer to its equator, lies the line round which any planet turns on itself,) the more direct, will be the action of the solar rays upon that torrid zone;—and, on the contrary, the broader is the torrid zone, (that is, the wider from its equator, is the line round which any planet turns on itself,) the more oblique, will be the Sun's action upon it. In Mercury, correspondingly, we have found a planet, in mitigation of heat, revolving on *his very poles*;—and in Jupiter, in like mitigation of cold, we now contemplate one, revolving within three degrees of his equator. Secondly,—This close equatorial rotation affords another benignant influence: Jupiter's equator, never being more than three degrees above the solar rays, both his poles must be enlightened by them at once:—consequently, instead of the dreary long nights of a remote region, the major portion of Jupiter must be cheered by a perpetual morn! An influence thus constantly benignant, combined with the mild radiance of the Sun's rays, as reflected in alternate succession, from one or other of the four revolving moons, each of them equalling our own entire planet,—the Earth,—in grandeur, manifest a *regenerative compensation* for solar remoteness, preeminently conducive to vegetation, in a planet, the magnitude of whose solar revolution necessarily renders *slowness in development*, inherent in all its productions. Thirdly,—The magnitude of Jupiter forms another instance of compensatory wisdom: —first, from the probable increase of heat incidental to the mighty mass of rays, accumulated by a surface of Jupiter's dimensions;—and secondly,—from the mitigatory importance of the *velocity* with which a bulk thus enormous, is proved capable of rotating. We know Venus to be 1,500 times smaller than Jupiter;—yet Venus turns on her axis only at the rate of 45 miles an hour; while Jupiter accomplishes the rotation on his, at that of 28,005 *miles an hour.*

And *wherein*, may probably consist the advantage of such immense velocity?—A moment's reflection may resolve the question; Nature never *wantonly exerting her energies.*

In Mercury, vicinity to the Sun renders long alternate relaxations from heat, essential to invigoration of vegetation throughout his surface;—and in Mercury, we find alternate hemispheric nights 88 of our earthly 24 hours, in length.—In Jupiter, *remoteness* renders perpetual recurrence of solar influence, throughout *his* surface, equally essential to vitality; and in Jupiter we find a rotatory velocity so astounding, as to be performed in rather less than 10 of our earthly hours. A rotation so rapid, as successively carries every portion of this magnificent planet within solar radiance, every 10 hours; everywhere precluding, by the shortness of the interval, possibility of its influence being exhausted.

"These are thy glorious works, Parent of Good!"*

Everywhere equally crowned with wisdom, as founded on power!

Nature, in planets more approximated to the Sun, has placed the continents in positions diverging from north to south poles. In Jupiter, the continents are evidently constructed in zones, parallel with, and close to, his equator, interspersed with alternate seas:—and immense must be the magnitude of these alternate continents and seas, to render them discernable, even by telescopes, from our remote region. This remoteness prevents our perception of the communicating passages between those alternate seas, necessary to the uninterrupted aquatic circulation, which, to planets, is what that of the blood, is to the human body.

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* Thomson's Hymn.

The continental alternations, thus surrounding Jupiter, are popularly called "Jupiter's Belts." The varying hues of these "Belts," demonstrate that planetary succession of seasons, crowns Jupiter with the "seed times and harvest times" of Omnipotence:—And it is interesting to trace, through their medium, the *measure of time necessary to physical development* in this remote planet.

For this purpose let us remark, that two at a time of the belts,—five in number,—are observed to become dark for the *period of six years;* during which, two belts of the opposite hemisphere retain lustre. At the end of six years, the bright belts become dark, and the dark belts regain brilliancy. This periodic variableness of colour, announces the vicissitudes of winter and summer; each season alternately comprising a period of six years in the hemispheres of Jupiter: the two belts, while crowned by the snowy lustre of a six years' winter, exhibiting corresponding brightness, and being restored by the periodic meltings of snow and ice, to the more sombre hue of summer vegetation.

Thus, in the alternate succession of every 12 years, the summers and winters of both hemispheres are displayed, with an exactness of long standing record; as is demonstrated by astronomical details of the September months of the years 1665,—1677, &c. &c. up to the year 1713, and onwards.

How can we sufficiently appreciate the luxuriance of a summer, of six years duration, invigorated by the previous fertilization of six years' accumulated snows, and under the perpetually revolving influences of four bodies of the bulk of Jupiter's Moons.——Plants,—of the construction of our mosses, may thereby everywhere attain the dimensions of cedar trees!

What, therefore, may be the magnitude of fruit and forest productions, in *the torrid zone of a planet,* 1,400 times larger than the Earth!—Above all,—what may NOT be the MAJESTY OF INHABITANTS, *created* for such magnificence!!

## TENTH PLANET.

# SATURN.

THE period of Saturn's revolution round the Sun, comprehends nearly 30 years;—consequently, a Being born in Saturn, and aged 15 of Saturn's years, must have attained the term of 450 of our earthly ones.

The scale of knowledge and intelligence, thus appears augmenting, as we advance towards the limits of our own solar system;—and the wonderful complexity apparent in the construction of Saturn, displays a magnificence, commensurate to the august natures of his inhabitants.

Saturn's diameter is 77,630 miles—his period of rotation on his axis, is about 10 hours;—his distance from the Earth, is nine and a half times further than the Earth is from the Sun:—and his distance *from the Sun* comprises 906 millions 183 thousand miles;—consequently, it would take a cannon ball 209 years, to progress from Saturn to the Sun.

We will now attempt a slight survey of the compensatory blessings, with which creative wisdom and power, have surrounded a planet, thus remote from solar station.

Like Jupiter, Saturn's continents appear to be placed parallel to each other, and to his equator;—Saturn, like Jupiter having five belts, of the above inclination;—like Jupiter, he turns on his axis with an inclination within three degrees of his equator—presenting, like Jupiter, every portion of his surface to the Sun's radiance, within the term of every 10 hours. But, the most remarkable source of mitigated temperature, is displayed in a *regularly constituted medium for the condensation of light and heat*, the perfection of whose mechanism, is astounding to human faculties.

This mighty apparatus, consists of two immense circles, the one within the other, with an intervening space between them, whose concave surfaces collect, and reflect, the solar rays, together with those of seven revolving Moons, in every conceivable direction.

Thus the inhabitants of Saturn, so far from being immersed in darkness, are in the enjoyment of a splendour, which might baffle those of the Earth, to imagine.

This stupendous exhibition of celestial machinery, is popularly denominated, "the double Ring of Saturn."—The dimensions are as follows:—according to Sir William Herschell.

## SATURN'S RINGS.

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|---|---|
| Inner diameter of the inward Ring | 146.345 miles. |
| Outer diameter of the inward Ring | 184,393 miles. |
| Inner diameter of the outward Ring | 190,248 miles. |
| Outer diameter of the outward Ring | 204,883 miles. |
| Breadth of inner Ring | 19,024 miles. |
| Breadth of outer Ring | 7,317 miles. |
| Vacant space between the two Rings | 2,947½ miles. |
| Distance of the interior surface of the inward Ring from Saturn's globe | 34,332 miles, |

or, about one seventh the distance of our Moon from the Earth. Hence, the diameter of the outer ring, is 26 times larger than the diameter of the Earth.

It is apparent, that the double ring of Saturn, produces the effect on its planet, accomplished by the double row of petals, on *their flower*, the daisy :—both, being equally created, for the *condensation of solar rays* on their *respective discs;* (with this mechanical difference, that Saturn's rings invigorate two hemispheres, instead of one,) and such is the inexhaustibility of nature, that perhaps, the double ring of the planet, cost no greater effort than the double petals of the flower.

Here let the reader imagine for a moment, the magnificent spectacle of one entire circle, 204,883 miles in diameter, and 19,024 in breadth,—in the rapid rotation around Saturn's equator, of 10 hours 18 minutes,—concentrating,—condensing,—and in every direction, DIFFUSING, the rays of the distant Sun around its primary:—the same impartial, paternal profusion, though on an enlarged scale, generating the springs of life, light, heat, of fructuation, plenteousness, and joy, around the remote planet of Saturn, which luxuriate within the blazing orb of Mercury.

The rotatory periods of these rings, are calculated from the outlines of *shadows*, discernable amidst the general brilliancy of their interior surfaces.—Outlines, indicating within these mighty circles, the *presence of mountains*, whose *irradiated summits*,—(on the principle of those in our Moon,) by catching the first, and retaining the last solar ray, become prominent reflectors in this encircling radiance.

What can surpass an horizon, superb like this? The rays of the far distant Sun, thus kindling the atmosphere of these reflectors.—Of reflectors, thus emblazed amidst stupendous circumferences, whose rotatory velocity—concentrates,—condenses,—refracts,—reflects,—and diffuses, in every possible direction, and in ceaseless succession,—a never-ending diversity of resplendent images!! What earthly object, can offer a comparison?

But when in addition, we contemplate the accompaniments of seven revolving Moons,—the nearest of them, displaying a surface *seven times larger than our own beauteous one*, and the six others, a harmonious diminution of size, *what* shall we say, to such an accumulation of magnificence? This astounding horizon, thus for ever in the rapid revolution of its successive radiances,—these seven majestically revolving luminaries,—*each*,—replete with the lustre of its own *host of reflectors*;—all,—blending their diversified influences into ONE HARMONIOUS EMANATION, the circulating medium of light, life, and joy, toward their primary,—*what shall we say* of such wonders,—such glories, ?—What CAN we say, except that the Creator, ever proportions his WORKS to their OBJECT,—and hence, in Saturn, displays a sublimity, befitting inhabitants, *the extension of whose existence, embraces centuries.*

Amidst these grandeurs, the following instances may be traced, of that provisional *minuteness of care*, pervading the sacred laws of nature's works.

1st.—A singularity in the orbits of Saturn's seven Moons, (hereafter to be adverted to,) consequent to the presence of the double Ring, which prevents their suffering eclipses, except when immediately crossing each others path.

2nd.—The absence of mountains on the globe of Saturn; as demonstrated from the inferiority of *his* brightness to *that* of his Moons. Impediment to horizontal rays from extent of shadows, *being thereby avoided.*

3d.—An encircling medium, 19,024 miles in breadth, by undue vicinity to its primary, might obscure from solar beams, by its own shadow, every portion of it in succession:—or, by a position too remote, might not reflect adequately, concentrated rays upon any part of that primary.—Hence, the perfection of that *proportional delicacy*, preserved in the distance of these rings from Saturn's disc,—a proportion, which by a minute correspondence between the breadth of these rings, and the distance of their interior surfaces from Saturn's globe, casts the shadow of this immense apparatus, beyond the bulk of Saturn.

4th.—The *globe* of *Saturn* revolves in 10 hours 16 minutes and 19 seconds. The *double ring*, in 10 hours 29 minutes 16 seconds. At first sight, perhaps, a mere trivial inconsequential difference in velocity;—on reflection, an instance of unapproachable mechanical perfection. Hence, during thousands of years, no portions of the globe and its rings, can, by any conceivable calculation, *present* the same *actual particles* to each other; and hence, a consequent *ceaseless diversity* in *magnetic polarity* is induced, the intensity of whose *renovationary functions*, almost amounts to infinite.

5th.—The separation between the two rings, must, by the *ceaseless activity* of their *mutually refracting action*, produce a *diversity of polarity* in the transversing solar particles, equally *beyond conceivable calculation* with the former magnetic instance; and augmenting thereby, the intensity of the *irradiating* principle as *powerfully*, as does *the other*, *that* of the *renovatory* one.

The telescopic appearances of Saturn, always beautiful, often superb, are fraught with variety from the diversity of aspects, under which we behold his rings, in consequence of the incessant mutation in position, of the Earth and of Saturn.

Every 15 years, these rings are beheld in the direction of our visual rays,—when dark belts,—similar to those of Jupiter, are visible round Saturn. One of these belts lies in the midst of his equator,—one 45 degrees on his northern,—and one 45 degrees on his southern hemisphere.

Saturn's annual course round the Sun, is accomplished in a period of 29 years 170 days.

## ELEVENTH PLANET.

# HERSCHELL.

THE first astronomical perception of HERSCHELL, was at the end of last century, when Flamstead presumed it a small star.—It is to Sir William Herschell, that science stands indebted for the discovery of its planetary movements.

This great man began to entertain conjectures respecting them in 1781, and by diligent observations, was enabled shortly after, to pronounce Herschell one of the planets of our solar system:—its revolution round the Sun comprising a period of 84 years, 24 days, and its distance from that luminary above 1822 millions of miles.

To form a feeble idea of the immensity of Herschell's remoteness from the Sun, we shall observe, that his course round the Sun, lies at the distance of 916 millions 230 thousand 970 miles, beyond that of Saturn:—or, at rather more than double the distance of Saturn from the Sun!!

Herschell's distance from the Sun, and the recentness of his discovery, render his construction an object of peculiar astronomical interest; since placed as he appears to be, *at the verge of our system*, his mode of receiving light and heat, must be fraught with mechanical marvels. This interest is increased, by the certainty already obtained, of orbicular diversity in *his* Moons, from all other Moons;—implying (as will be found further on) the existence of a surrounding, condensing apparatus for light and heat, on the same principle as Saturn's double ring, but of magnitude immensely more stupendous.

Herschell's line of rotation on his axis, has not been ascertained.

It is calculated, that Mercury, Venus, the Earth, and Mars, are generally invisible to the inhabitants of Herschell; comparative solar vicinity, rendering those planets to *them*, like Mercury to us, lost in the radiance of the Sun. But the remote station of above 1800 million miles from the centre of *our solar system*, somewhat approximates the orbit of Herschell, towards the verge of *others*.

THERE ARE NO VOIDS IN CREATION!!! The glories of one system, are only bounded by those, of innumerable surrounding ones!!! An inhabitant of Herschell, aged *one of Herschell's years*, has attained 84 *of ours*:—and *his* faculties are only beginning to unfold, when ours, have sunk exhausted, into the grave.

Of what expanding influences may not Beings, thus supereminently constructed, partake;—what glowing marvels,—diffusing countless energies around, may they not survey—as *their* glorious planetary habitation—*Herschell*—with its encircling Moons—rolls onward, along the precincts of one magnificent system after another, in the full majesty of its own superlative revolution,—around its own, life diffusing Sun!—A revolution, requiring above 84 of our years for its accomplishment,—and comprising 11 thousand, 450 millions, 44 thousand, 320 miles, in magnitude.

# CLASS THE THIRD.

## THE EIGHTEEN SECONDARY PLANETS, OR

## MOONS.

AMONG manifold instances of the provisional care everywhere abounding with a magnificence crowned with beauty, may be cited, the superb machinery of the *secondary planets*,—or MOONS. Their powerful agency consisting in the *production for their relative primaries, of the greatest possible solar influence*, through the greatest possible *lunar reaction*, it is desirable to attend (as far as present lunar knowledge permits) to certain peculiarities in the atmosphere and surface of our own Moon, powerfully conducive to this effect.

Around the Sun,—the transcendent alchymist of planetary illumination,—we have observed, the stupendous force propelling machinery, of *an atmosphere*, 18,000 *miles in height*:—and around Mars,—as the grand, but sole condenser of remote rays for that planet, we have observed an atmosphere of altitude and density, efficient, from excessive refraction, for the absorption and augmentation of solar influences, to an inconceivable degree. But, in the atmosphere of the Moon, placed as *she* is, to enlighten her primary—the Earth—created as *she* is, not to absorb or strengthen for *herself*, but minutely to collect, and rapidly to return solar rays, —what do we find?—We find an atmosphere barely three miles in height, of such excessive rarity, and so excessively attenuated, as with difficulty, and but seldom, to be discerned. Hence, very nearly unimpeded by atmospheric refraction, the *rapidity* with which solar rays are *reflected back, through lunar reaction*.

An able writer has observed, that "were the Moon smooth, and polished on her surface, or covered with water, she could not collect and reflect the Sun's rays, although in some positions she would display his image to us; but *that*, no larger than as a single point, and with a condensed lustre injurious to our sight."

Behold, therefore, as the Moon turns, either towards or from the Sun, another instance of creative benignity, in the *variety of surface*, she exhibits:—behold it, in a beauteous assemblage of mountains,—whose summits first catch, or last retain, the first or the last ray, from the very first or very last glimpse they obtain, of his mighty orb: —behold it, in her dark and deeply ravined valleys; those condensing focuses of surrounding irradiation! Behold, this superb assemblage of magnifiers and reflectors, incessantly preparing, and instantaneously returning, in the softened tints of lunar radiance, the glowing ardours of solar refulgence:—behold *these glories*, and let us turn, in grateful admiration, towards our own Moon.

## THE

## SINGLE MOON OF THE EARTH.

THE Moon, like her primary,—the Earth,—is an opaque body, shining by light received on her surface from the Sun, and reflecting it back on the Earth. The Moon's diameter comprises 2,160 miles, and her mean distance from the Earth, 237,000 miles. The Moon revolves round the Earth, from west to east, in a period of 27 days 7 hours 48 minutes 11 seconds, at the rate of 361 miles an hour, in a circuit inclining towards an oval, and wherein the Earth is situated towards one of the ends.

The revolutions of the Moon round the Earth, are performed in specific sequences of spiral* courses; —each distinct series, carrying the Moon in her orbits round the Earth, by the above spiral courses, from the fifth degree, 8 minutes 48 seconds on *one* side of the line of the Earth's ecliptic, to the fifth degree 8 minutes 48 seconds, on the opposite side of her ecliptical line; comprizing a zone, of 10 degrees 18 minutes, of which, the ecliptic forms the centre line. From this zone, the Moon's courses never diverge: since, the boundary on one side attained, a fresh series of spiral courses round the Earth commences, though of contrary divergence, which (as it were) reconducts the Moon, by corresponding spiral courses, towards the former, and opposite boundary. These two express series of spiral courses, constitute the never diverging, although diversified, path in the heavens, of the Moon. The period for the accomplishment of each diverging series, occupies 235 months,—or 18 years and a half,—each lunar month, as before stated, comprising 27 days 7 hours 48 minutes 11 seconds.

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* Spiral course.—A curved line winding round nearly in a circle, but not meeting to run again into itself; each winding continuing onwards at a proportionate distance from the last.

It is apparent from the direction of these spiral courses, that the Moon must cross the ecliptical line *twice*, during each revolution around her primary,—the Earth;—namely, once in ascending from the south to the north hemisphere, and once in descending from the north to the south hemisphere. The points of these intersections (or crossings) are called "the Moon's nodes;" and attention to the precision of these periodical crossings, may assist the student in forming an idea of the *three distinct*, but *relatively combined* revolutions in space, of the Earth and her Moon.

We find the Moon travelling round the Earth at the mean distance of 237,000 miles, at the rate of 361 miles an hour If, therefore, the Earth stood still, the Moon would always arrive at the same crossing point on the ecliptic, in a period of 27 days 7 hours 42 minutes and 4 seconds, from the moment she last left it ; and *that*, by the same path in the heavens :—but, we must recollect, that while the Moon revolves round the Earth, the Earth keeps moving onward, in her annual revolution round the Sun, at the rate of 64,000 miles an hour. The attraction of the Earth, carrying the Moon along with her through the entire solar course, the advance thus making in it by the Earth, produces a *corresponding enlargement in the circuit to be performed round the Earth*, from one crossing point to the subsequent next crossing point, by the Moon. From this compelled increase of lunar circuit, the period of 29 days 12 hours 44 minutes and 2 seconds, would be requisite, for the Moon to revolve from one intersectional point to the next, did not the Earth, in addition,—we must remember, —turn in the same direction, on her own axis ;—a rotation whose superior velocity to that of the Moon round the Earth, somewhat counterbalances the prolongation of that lunar circuit. The Earth's mean motion on her axis, being at the rate of 732 miles an hour, and that of the Moon round the Earth being only 361,—and both moving the same way,—the Earth necessarily *outstrips* the Moon in her movement,—and thus accellerates the actual moment of ecliptical point intersection. From the combination, therefore, of these three divers, but relative movements, the precise period requisite for the Moon to revolve from one crossing point to another, consists of 27 days 7 hours 48 minutes 11 seconds ;—with this *express distinction*, that in consequence of the above augmentation of lunar course around the Earth, each crossing point is invariably, attained by the Moon, a *little short* of the preceding one. The most exact calculations, exhibit an average retrogradation of the Moon's node, (or point of crossing the ecliptic) amounting to three minutes ten seconds per day.

In this nearly imperceptible diurnal variation, the same harmoniousness in design is observable, with which creative wisdom ever propels,—through minute operations,—the *most magnificent vicissitudes.*

The Moon thus daily losing ground (as it were) in her course round the Earth, it follows, that this crossing point must in time, be carried round the whole ecliptic. And, accordingly, we find, that in a period of 6,793 days and a fraction, or, in 18 years 223 days 7 hours and 17 minutes, this intersectional point, *is* actually carried throughout the entire circumference of the ecliptic;—the point of crossing, at the middle of that period (namely, 9½ years) being precisely opposite the one, at its commencement.

Every 29 years and a fraction (that is, after the accomplisment of every two, of the above *complete* retrograde revolutions of the crossing point around the ecliptic) the same *lunar phenomena are repeated:* because, every 29th year and a fraction, the Moon, by crossing the same exact point of the ecliptic, from the same side of diverging boundary, actually *recommences, that double series of oscillatory spiral courses*, occasioning their occurrence.

Hence, to the eye of ignorance, the apparently endless eccentricity of the Moon's evolutions;—although the development of science, demonstrates their accomplishment with a regularity and precision, admitting of the perspective calculation of centuries: and hence, while minuteness of daily retrogradation, precludes perception of much diurnal deviation in the Moon's path, different periods of each ecliptical revolution display the Moon, majestically moving before an endless variety of stars;—nay sometimes, eclipsing the very Sun himself,—as in the course of every 29 years and a fraction, the ceaseless series of her spiral courses, carry her between the Earth, and every constellation illuminating her circumscribing zone, of 10 degrees and 18 minutes.

Thus it will be remarked, that there exists no essential eccentricity, in the Moon's orbits. Like every other celestial body,—*she* moves steadily and right onwardly, throughout her appointed courses;—and it is the Earth's own rapid, and double,—although equally defined, evolutions, which, to a spectator on any one given spot *on the Earth's surface*, distort the Moon's regular movements into apparent eccentricity. Could that spectator, behold the Moon from a *fixed station in space*,—the regularity of her courses, would be evident; "but the Moon, (to use Sir John Herschell's words,) is our nearest neighbour,—vicinity, renders her minutest movements striking to us," while our own rapid diurnal rotation and solar revolution *combined*, constantly carry our spectator, on his one given spot, beneath fresh aspects, continually presenting the Moon to him, in positions the general diversity of whose angles, our spectator's own evolutions greatly augment. The fallacy of *apparent velocity* in the Moon's motion, will be likewise perceptible;—since, far from the most rapid, it will be proved the *slowest*, of any known celestial course. Above all, the Moon's appearing *to fly from us through our hemisphere in a westwardly direction*, will be recognized as an illusion, produced by the velocity of our own planet's rotatory action;—and it will be found, that during the whole of this *supposed lunar spectacle*, the Moon is, actually going *slowly the same way that we are*, namely, from west to east,—while *it is the spot from whence we contemplate her*, which in fact, overtakes,—outstrips,—flies past,—and finally descends out of her view, through the rotation of its own entire planet,—the Earth.

Notwithstanding the general illumination of half the lunar disc, by the Sun, the various angles at which the Moon is seen from the Earth, during each revolution, occasion the appearance of the Moon to undergo, towards her primary, the Earth, *continual* and *successive changes.** In one part of the Moon's circuit around us, we behold her shining at midnight, on our meridian, or, in that portion of the heavens opposite the Sun. From this direct position, towards us, she displays an orb completely circular, and is called "the full Moon." As she travels eastward, a portion of her dark, or western side, becomes perceptible to us;—and in about seven days more, we see her on the meridian, about six in the morning, wearing the appearance of a semicircle, with the convex side towards the Sun. In this state, we call her "the half Moon." —Continuing to travel eastward, the portion of her dark west side is brought forward, by the angle at which we contemplate her; and she assumes, towards us the form of a crescent, with the convex or illuminated side, still towards the Sun. This form gradually becomes more slender; till about 14 days after the full Moon, we cease to see her, in consequence of her coming between the Sun and the Earth: since, in this position, the illuminated half of her disc being turned towards the Sun, and the darkened half being towards us, she necessarily becomes invisible. About four days after this disappearance, we again behold her, a little eastward of the Sun, in the evening, in the same beautiful form of a crescent; with its convex, or illuminated side, in the opposite direction; that convex side being as before, turned towards the Sun. Travelling still eastward, the crescent form appears gradually to widen; until about six in the evening, seven and a half days afterwards, she again exhibits to us in the meridian, the appearance of a bright semicircle, with the same difference observable in the crescent form; namely, the direction of her illuminated, or convex side, being again towards the Sun.—Still advancing eastward, the semicircular form appears from her relative position towards us, expanding into an oval; and at the end of about 28½ days, she is once more beheld in her former direct opposition to the Sun, having resumed, as beheld from the Earth, the splendour of "the full Moon."

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* These changes are called "phases."

From this detail it is apparent, that the Sun, can be eclipsed *only*, at the period preceding a new Moon, (or, when the Moon, comes positively between the Sun and the Earth) and that the Moon, can *only* be eclipsed when full, or, when directly on the opposite side of the Earth, from the Sun. Were the Moon's course confined to the Earth's ecliptic, total solar eclipses would attend each lunar revolution; but, among other beneficial effects of the variety caused by the spiral nature of the Moon's courses, is that, of preventing this constant recurrence of entire solar obscurations, by a modified succession of eclipses, *sufficient to atmospheric renovation, by their peculiar electric excitement.* The powerful mental impetus, afforded by scientific observation of eclipses, it is unnecessary to dwell on, in this work.

The splendour of the Moon, is undoubtedly greatest at the full,—but the phenomenon of her vallies and mountains, offer objects of peculiar interest, as viewed through glasses, during the periods of her *increase* and *decrease.*

When the Moon, after her disappearance, as previously stated,—is again discerned by us, it is in the form of a slender crescent; the convex side, or that next the Sun, being illuminated, and its line perfectly defined;—while the opposite one, appears to us uneven and ragged, "as though (says a popular writer) the edge were notched into innumerable breaks."—This indented roughness, offers us the earliest indication of *lunar surface inequality.*

About the fourth day from this reappearance, the summits of mountains are first discerned by us. Those on the rough, or furthest side from the Sun, are the first apparent, and become visible in the fashion of minute lucid points, arising just within the dark portion of her orb. In the course of three or four days, the limits of these augment in size, gradually expanding toward the illuminated portion of her disc,—while the actual *points*, we must observe, *turn invariably toward the dark side.* Various shining patches, are next discernable within that dark portion;—at first detached,—next feebly united,—then more vividly coalescing,—until blended altogether, within the increasing limits of the illuminated surface. As the Moon thus turns more and more of her enlightened surface to the Earth, successive fresh luminous portions arise to our vision; becoming in like manner, irradiated,—until at length, the orb assumes, towards us, the circular form of "the full Moon." After the full Moon, a fresh series of like angular positions commences (though of direction exactly contrary to the preceding one) presenting the Moon to the view of the Earth, for the remaining part of the circuit around her, under the succession of *decreasing phases*, though of contrary aspect to the preceding ones, and with the precise contrary series of *appearances* on the Moon's surface: that is, lucid points, on the remotest side *from* the Sun, being seen by us, *receding in sequence corresponding* to their vicinity towards the illuminated portion. As the Moon turns her dark side more and more to our observation, each class of successive luminous patches,—in *like opposite distinction*, being beheld by us, first, as *decreasing* in *brightness*,—next appearing circular,—and finally disappearing gradually. The same distinct circular line on the convex line, or that next the Sun, and the same indented roughness on the edge remotest from him, again attending our spectacle of the slender crescent form, as exhibited by the Moon previous to her disappearance, through her renewed passage between the Earth and the Sun.

It is especially to be remarked, that through both series of phases, and from whatsoever portion of lunar course viewed by us, these actual *lucid points*, *invariably turn towards the adjacent dark part*—that is, in the direction diametrically opposite the Sun; since we must remember, that *this fact*, demonstrates not merely the *existence of the mountains* whereof these *lucid points constitute the summits*, but that it likewise illustrates their *height*. Astronomical observations on the shadows, and other varying appearances of these points, before and after the full Moon, furnish pretty accurate date of their mountainous elevations. Some of these mountains are ascertained to reach the height of two miles;—a *considerable altitude* in a planet, remarkable, like the Moon, for thinness of atmosphere, and evidently displaying the importance of their agency; as *reflectors of solar beams*, thus beneficiently returned upon their primary the Earth, by the irradiated summits of these mountains.

The telescope displays a succession of interesting objects in these lunar mountains and valleys;—the shadows of the mountains, being, as remarked above, invariably thrown from the side remotest the Sun,—while peculiar brightness animates that, next him;—and, on the contrary, the valleys, being illuminated as constantly on the *further* side, and being thrown proportionally into shadow, on that next the Sun. Both these series of shadows become shortened, as the Moon turns her face more and more towards the Earth,—or, as she approaches the full;—and at its accomplishment the Moon, being then directly opposite the Sun, and *the Earth between the two orbs*,—the disappearance of all shadows on lunar surface, takes place, as viewed from the Earth.

During the third, and also during the last quarter, of her course round the Earth, shadows reappear to our view, but falling in contrary direction on the lunar surface;—namely, those of mountains, being again thrown from sides furthest from the Sun, and shadows of valleys, from those nearest him.

Mountains, are scattered over the whole lunar surface ; telescopes exhibiting numerous instances amongst them, of decided volcanic nature ; in some, amounting to positive stratification, from ejected deposits. The blaze of lunar volcanic irruptions may be frequently seen, even through inferior glasses—The writer of these few remarks had the pleasure of contemplating one, for three successive evenings, in the October of 1835.

All mention respecting the mechanical solar, and lunar influences on the tides, having been avoided in adverting to the planet "the Earth,"—it will only be observed here, that a high tide, always attends the full Moon. It is evident, that the united influences of the Sun and the Moon, are then, *direct* on the Earth :—but, that the most considerable tides must necessarily prevail at "the new Moon."—The Sun and the Moon, being then on the same side of the Earth, and their respective influences acting positively and conjointly together, these combined energies, must prove correspondently effective.

The disc of the Earth's Planet, must form a magnificent spectacle from the Moon! Sir John Herschel says, that the Earth's apparent diameter, must, as beheld "from thence, amount to three degrees in size—being immutably fixed in their sky ; while the stars, must seem to pass slowly behind, and beside it."

## THE
## FOUR MOONS OF JUPITER.

It is only 227 years, since the optical skill of the immortal Galileo, unfolded the portals of science to man, by the invention of the telescope;—at first, a comparatively rude instrument, called "Galileo's tube;"—progressively improved, by the intervention of men of science;—but its present relative excellence, having been developed by the enlightened energy of Sir William Herschel.

The splendour of Jupiter, rendered him one of the first objects of Galileo's attention.

On first presenting his "tube" towards Jupiter, the surprise of Galileo was immense, to see, close to one of his sides, "*three very small shining bodies.*" The following night, he eagerly resumed his inspection of these "three little shining specks." Again, in truth, he beheld two of them; but those two, were on the contrary side of Jupiter. This circumstance perfectly astounded Galileo; riveting his attention to its development. A fourth Moon, in subsequent observations, also appeared; and in a short time, Galileo could no longer refuse to believe, that these "small stars," were four Moons, revolving round Jupiter, in the same manner as our Earth is accompanied by her single attendant. "It is difficult," says the author of the Life of Galileo, "to describe the extraordinary sensation which this intelligence produced. Many doubted, many positively refused to believe, so novel an announcement; all were struck with the greatest astonishment, according to their respective opinions, either at the new view of the universe, thus offered to them, or, at the daring audàcity of Galileo, in inventing such fables."

Jupiter's Moons, are arranged nearly in a right line parallel to the plane of his belts, and revolve round him in different periods, and at unequal distances. Their relative situation with regard to Jupiter, and to each other, are constantly changing. Sometimes, they all appear on one side of his disc, sometimes, on the other: but more commonly, some of them on one side, and some on the other. Their orbits are circular, and the rank of each Moon is determined, by the magnitude of its particular orbit: that of the smallest, being considered as the first. Each Moon turns likewise once on its axis, during each revolution round Jupiter; (in the manner of our own Moon) and from these two counteracting motions, Jupiter's four Moons (like our single one) always turn the same side, to their primary,—Jupiter. One revolution round Jupiter, constitutes the day and night of each of his Moons; while the length of the year of all the Moons, is the same as that of the course of Jupiter round the Sun.

Jupiter's Moons are subject to innumerable eclipses. These afford boundless scope, not only for astronomical observations, but, for scientific discoveries of various descriptions. One of the most important, is the solution they offer of the problem in natural philosophy, "whether light be instantaneous, or progressive?" Repeated astronomical observations have proved, that when the Earth's position is exactly between Jupiter and the Sun, (or the position nearest to Jupiter) his Moons are seen eclipsed, eight and a half minutes sooner, than stated in the tables:—but when the Earth is in the remotest part of her orbit from Jupiter, these eclipses are seen, about eight and a half minutes later, than the tables predict. Hence, the motion of light is ascertained, not to be instantaneous, but progressive; and moving, at the rate of 200 thousand miles per second; because, the diameter of the Earth's orbit, being 190 millions of miles, light is hereby demonstrated to take about 16½ minutes and two seconds, to pass along that line of distance.

### *Orbits and distances, from their primary, of Jupiter's four Moons.*

| Moons. | Periods of revolution. D. | H. | M. | S. | Dist. from Jupiter. |
|---|---|---|---|---|---|
| 1st Moon ......... | 1 | 18 | 27 | 33 ...... | 264,490 Miles |
| 2nd Moon ........ | 3 | 13 | 13 | 42 ...... | 420,815 Miles |
| 3rd Moon ......... | 7 | 3 | 42 | 33 ...... | 671,234 Miles |
| 4th Moon ......... | 16 | 16 | 31 | 50 ...... | 1,180,582 Miles |

## THE
## SEVEN MOONS OF SATURN.

THE seven Moons of Saturn, like those of Jupiter, revolve round their primary at different distances, and in unequal periods: but in consequence of the plane in which they move, being considerably inclined towards the plane of Saturn's path round the Sun, their eclipses appear not so frequently, as those of Jupiter's Moons.

From Saturn's remoteness, his Moons are only visible with a good telescope ; but with that, their magnificence becomes apparent. The nearest of them, is demonstrated, as displaying to its primary, a surface, *seven times larger than that of our own Moon* to us ; and the remotest, a magnitude equaling that of Mars.

A striking instance of provisional care is exhibited, in the great obliquity of the orbits of these Moons. The precision of this obliquity is so exact, that the planes of all their orbits, move along those of the double ring; never intercepting, or crossing them. Hence, these splendid luminaries, are never-failing irradiators of some portion or other, of their august primary.

The peculiar and invariable splendour of the sixth Moon, whensoever seen on the right hand of Saturn, or near that Moon's greatest western distance from him, and its gradual diminution, and total disappearance, as progressing towards, and arriving at, its greatest eastern distance from Saturn, convince astronomers, that this sixth Moon, at least, revolves round its axis; and that, in the same period as it revolves around Saturn.

*Orbits and distances, from their primary, of Saturn's seven Moons.*

| Moons. | Periods of revolution | | | | Dist. from Saturn |
|---|---|---|---|---|---|
| | D. | H. | M. | S. | |
| 1st Moon ...... | 0 | 22 | 37 | 23 ...... | 119,627 Miles |
| 2nd Moon ...... | 1 | 8 | 53 | 9 ...... | 153,496 Miles |
| 3rd Moon ...... | 1 | 21 | 18 | 26 ...... | 190,044 Miles |
| 4th Moon ...... | 2 | 17 | 44 | 51 ...... | 243,449 Miles |
| 5th Moon ...... | 4 | 12 | 25 | 11 ...... | 340,005 Miles |
| 6th Moon ...... | 15 | 22 | 41 | 14 ...... | 788,258 Miles |
| 7th Moon ...... | 79 | 7 | 54 | 37 ...... | 2,297,155 Miles |

## THE

## SIX MOONS OF HERSCHEL.

THE discovery of Herschel being recent, and his distance immense, only six* Moons belonging to that planet, have been hitherto discovered; but the undue distance between the fourth and fifth Moon, renders the existence of an intervening orb probable.

The striking difference of their orbits, from that of all other Moons, may probably, afford scope to the science of future generations, for most novel, and important views of planetary magnificence. Herschel's Moons, contrary to all others, revolve round him from east to west:—but nearly perpendicularly, to his ecliptic: by analogy, consequently, some mighty apparatus, corresponding to the double ring of Saturn, but exceeding it in vastness, may be expected, as hereafter unfolding, to scientific research. The approach to perpendicularity of these lunar orbits, appear demonstrative of this additional annular splendour; obviating, by a sublime mechanism, intersection, with any such presumed apparatus. From the plane of these lunar orbits passing twice a year, through the Sun, eclipses of Herschel's Moons, may frequently occur; but can only be observed by us, when he is in opposition to the Sun. When thus beheld, these Moons appear to ascend, through the shadow of Herschel, in a direction very nearly perpendicular to the ecliptic.

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* Since the above was written, the discovery of the intervening Moon has been announced.

*Orbits and distances, from their primary, of Herschel's six Moons.*

| Moons. | Periods of revolution. D. | H. | M. | S. | Dist. from Herschel. |
|---|---|---|---|---|---|
| 1st Moon ...... | 5 | 21 | 25 | 21 ...... | 224,155 Miles |
| 2nd Moon ...... | 8 | 16 | 57 | 47½...... | 290,321 Miles |
| 3rd Moon ..... | 10 | 23 | 3 | 59 ...... | 339,052 Miles |
| 4th Moon ...... | 13 | 10 | 56 | 30 ...... | 388,718 Miles |
| 5th Moon ...... | 38 | 1 | 48 | 0 ...... | 777,487 Miles |
| 6th Moon ...... | 107 | 16 | 39 | 56 ...... | 1,555,872 Miles |

# CLASS THE FOURTH.

# COMETS.

THE opinion of mankind has fluctuated in nothing more, than respecting the nature of COMETS. Two centuries ago, prejudice regarded them, as objects of terror, and agents of wrath. It now presumes them, liable to impediments, and positively, to be hastening towards their own annihilation. Calculations are extant, of periods, when two or three of those best known, are "to fall into the Sun:"—and if a Comet "*delays*" (as it is called) for a few days his predicted appearance, it is accounted for by assuming, that one planet has impelled him one way, and another another, until the discussion resembles anything, except one on a body comprehending alike hundred thousands of years in duration, and of miles in extent.

Comets, revolve around the Sun like the primary planets, but in orbits of various comparative magnitudes; many of which, are immeasurably prolonged. Some Comets approach so near the Sun as for a time, to be lost within his rays; and then, recede from him, beyond the known limits of our system. Many Comets, do not return towards the Sun, until the lapse of centuries. More than 500 Comets belong to our system; but, from the immensity of most of their orbits, the courses of only 98, are in any degree, ascertained.

In this comparatively early astronomical age, a remark is here, ventured to be suggested.

*One fundamental principle*, appears pervading every part of the *Creator's works*, as the appointed means of universal preservation. This principle, the writer begs to call (until science suggests a fitter term,) " OSCILLATORY ROTATION."—*Nothing created, is at rest:* no, not even our equinoctial, or our perihelion points. From our very Sun, his blessed self, down to the single drop of ocean, first, raised as vapour, next refined into gas, —then gradually recondensed—and finally again embosomed within its native sea,—EVERYTHING *is in rotation*,—even ROTATION *its very self;* and that, by laws as express, as immutable: the preservation of the *entire creation depending* ON THE ENERGY OF THEIR MAINTENANCE: since, on the *oscillatory rotation of each component part*, RESTS THE STABILITY OF THE UNIVERSE!!

In manifestation of the oscillatory rotation, pervading component parts, let us cite *the succession of our Moon's spiral courses.* No two successive courses are alike; each, belonging to a distinct series of orbits, progressing towards one or other of the boundaries of that zone (of five and a half degrees on either side of the ecliptic) which circumscribes the divergencies of our Moon. The first boundary attained, a fresh series of spiral courses commences, but of contrary direction, and tending towards the former boundary, of orbicular divergence. Hence, the undeviating recurrence, every 18 years and a half, of the same lunar courses; maintaining, with the precision of a pendulum, the principle of that OSCILLATORY ROTATION, upon which, rests the durability of the *Moon's revolutions* round her primary—the Earth.

Shall the courses of a body, comparatively so minute in creation, as our Moon, be regulated by laws thus precise, and shall those of *such mighty agents as Comets*, be exposed to CASUALTIES?

It is yet difficult, to expand the mind towards infinitude;—but the diligence of astronomers, may *henceforward record the revolutions of Comets*, with the exactness already obtained for lunar ones; and an *orbicular zone*, corresponding with that of our Moon, may HEREAFTER be demonstrated, as *circumscribing the courses of* each Comet round its primary, the Sun. Within the boundaries of THAT ZONE, a like *double series of courses* may hereafter be found *regulating the orbits of a Comet*, with a grandeur, commensurate to its magnitude, and a precision impervious to deviation.

The records of Halley's Comet, corroborate this assertion. The earliest attested mention of Halley's Comet, is in the year 130 before Christ; when it is dwelt on, as "*a prodigy in size, and tremendous in operation:* and about every subsequent 700 years, the terrors of mankind have registered it, as a most awful, and in one or two instances, "*horrible phenomenon.*"

During the intervening periods, the accounts concerning it, first diminish in importance;—then, become reduced to mere casual mention of "the appearance of a Comet:—next recommence augmenting in importance, until—"a magnificent," and at length, a "tremendous, and terrific" Comet is once again recorded, as appalling by its magnitude, and devastating by its effects. According to the undulatory principle thus evidently exhibited by these records, the late visit of Halley's Comet, occurred in an intermediate period of *comparative unimportance*, and the inhabitants of the Earth will not behold this Comet in full splendour, till the year 2060.

Comets, pervade all space.—The velocity of their movement, like that of planets, increases, the nearer they approach the Sun. The orbits of many, contrary to those of planets, incline from east to west.

A Comet examined through a telescope, has the appearance of a collection of vapours, attending a dark, ill defined *nucleus*—or head. This *nucleus*, generally increases in brilliancy, as the Comet approaches the Sun, and decreases, as it recedes from him.

The magnitudes of Comets, are very various. Some, are not larger than our Moon: some, three times the size of the earth:—multitudes, have no tails at all; the length of some tails amounts to 80 *millions* of miles. The rarity of their circulating medium, must be extreme, since stars are visible through these tails, and the Comet of 1770, swept among the Moons of Jupiter, without causing derangement.

A faint idea may be obtained of the diversity in the sizes and orbits of Comets, from what follows.

The smallest known Comets, are those of, Enake, the period of whose orbit comprise 1207 days, and that of Bela, accomplished in about six years and a half. During the present period, the respective series of both of their orbits, according to the foregoing hypothesis, incline towards the Sun,—the first, by the acceleration of one day, and the last, by the acceleration of two days, in each return. Both these Comets are without tails, and so small, as barely to be visible without glasses.

Let us now consider the Comet of 1744. The diameter of its nucleus, nearly equalled that of Jupiter; and its tail, extended 40 degrees from its body; remaining visible long after *that* was under the horizon, and extending towards the zenith, above 30 degrees for two hours, before the Sun became visible in a morning.

The Comet of 1680, is the most remarkable on record. This Comet, was visible four months. Its tail, was of a most enormous length;—extending over a space in the heavens, nearly equal to one fifth of their entire circumference. It *descended*, from the upper regions of space, *almost perpendicularly*; and, having passed round the Sun, within 147 thousand miles of his surface, *reascended*. It travelled at the rate of 880 *thousand miles an hour*; but, as it approached the Sun, its velocity became so astounding, as to carry it half round his disc, at the rate of *one million* 240 *thousand*, 408 *miles an hour!!* During the above solar proximity, this Comet must have been exposed to a heat, sufficient to have converted all terrestrial substances into vapour;—the Sun's disc, as then viewed from it, extending from the zenith to the horizon.

The furthest point of distance from the Sun, in the orbit of this Comet, as determined by Dr. Halley, amounts to eleven thousand, two hundred millions of miles, and the period of its return, to 575 years.—It is calculated, that from the remotest distance of its orbit, the Sun, as beheld from the Comet, would appear no larger, than half the diameter exhibited to us, by Mars. Astronomers have calculated, that one of the returns towards the Sun, of *this Comet*, must have taken place about the period of the deluge.

The tail of a Comet, is very short at its first appearance; augmenting as it approaches the Sun. It is longest and most luminous, immediately after the perihelion, when it is somewhat bent; the convex side, which is turned towards the path of the Comet, being brighter than the concave. The matter of which these tails are formed, is excessively rare, and possesses so great an affinity with the zodiacal light, and the aurora borealis, as testifies solar atmospheric action, to be their common cause.

The tails of Comets undergo the following changes of appearance, within each relative position towards the Sun: viz.

1st.—When a Comet is approaching the Sun, the train of light follows it. It is then called " a tailed Comet."

2nd.—When a Comet moves from the Sun, the train of light precedes it, in the form of a beard. It is then called a "bearded Comet."

3rd.—When the Sun and the Comet are opposite each other, and the Earth is between them, the train of light being behind the body of the Comet, developes itself around the extremities, like a border of hair. It is then denominated a " hairy Comet;" from the word "*coma*," which signifies hair.

The Comets here alluded to, are comparatively near our observation. Powerful glasses exhibit numbers, beyond the compass of unassisted vision. One hundred and forty Comets appeared in the course of last century, within the Earth's orbit, without returning. An abstruse calculation of M. Arrago, makes " more than seven million Comets, *frequent this planetary system*."

The orbits of *multitudes* among them, lie beyond human research, *belonging to neighbouring systems*, and visiting ours (probably) at the period of *aphelion* from their native Sun;* some of them, not approaching nearer our Sun, than within the orbit of Herschel.

What a sublime contemplation is presented by the theory of Comets—thus *interlacing*, as it proves them to do, the sacred influences of one solar system, with surrounding ones!!! Grand circulating developers of magnetic electricity,—Science, will at length demonstrate in the functions of Comets towards planetary and solar existence, the *veins and arteries* of *Universal Vitality*, enfolding Infinitude, within a common, and ever regenerative Medium!—Agents of grandeur proportionate to energies thus awful,—what a spectacle is permitted to man, in beholding Bodies thus tremendous, traversing immensity with such appalling rapidity; and yet within limits prescribed, *thus wheeling about*, with a regularity so minute!

How astounding, is such a combination of furious velocity, and minute precision: and what must be the magnificence of the Universe, when even the *infinitesimal portion* of it, allotted to our solar system, admits of revolutions thus awfully stupendous!!

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* Furthest part of their courses from their native Suns.

# DISTANT GLIMPSES.

## DIVISION II.

# DISTANT GLIMPSES.

## DIVISION THE SECOND.

### CELESTIAL BODIES, COMPARATIVELY REMOTE, FROM MAN'S ACTUAL POSITION IN SPACE.

PROBABLY, the most preposterous of all suppositions was that of the dark ages, in presuming the luminary we call the Sun, to be the source of, or increase of light to, the celestial bodies we denominate *stars*.—Those mighty IRRADIATORS OF INFINITUDE, multitudes of them too remote for human calculation, and to the majority of whom, the very existence of our planetary system, is imperceptible! Yet, such was the stupidity of those times, as absolutely to circumscribe the universe, within the limits of its own habitation,—proclaiming the Earth as the centre, and Man as the object, of creation!!!

Into a labyrinth so intricate did absurdity involve itself, as first to proclaim the Sun as the largest of all bodies, and next to announce him as daily whirling round the Earth, at the rate of twenty-four million eight hundred and seventy-one thousand miles an hour ;—a rate at which, by the most moderate computation, the Sun must thus have travelled !

After this progress in extravagance, it easily assumed certain shining specks, it affected to call stars, to be tastefully dotted about the *firmament*, for the exclusive gratification of man ;—although, according to the hypothesis of the Earth's immovability, it became necessary for the "bespangled FIRMAMENT"—(as stupidity chose to call, what this supposition rendered as little of a FIXTURE, as might be,) for the bespangled firmament, to keep spinning round the Earth with a velocity, beyond the reach of numbers ;—and compared to which, that of the Sun's imagined course of twenty-four million eight hundred and seventy-one thousand miles an hour, is a snail's pace ! Because, the circumference of the firmament, lying immeasureably beyond that of the presumed revolution of the Sun,—a proportionate velocity attended the supposition of the *firmament getting round the Earth* in an equally brief period. Ignorance thus profound, making man the *pivot of one tremendous whirlpool*, could, and did produce mental prostration, befitting any portion of credulity.

Happily the progress of science already opens more rational views of creation. Man now beholds every drop of water,—every particle of dust,—nay, the very air he inhales, *peopled with existence;* and may no longer blindly presume, the only *untenanted portions* of creation, to be the most magnificent amidst its wonders, nor presumptuously attribute to Divine Wisdom, the formation of myriads upon myriads stupendous globes, splendidly befitting sentient natures, for the meagre purpose of furnishing an occasional faint light to the Earth's small planet, which an additional Moon would more effectually have accomplished.

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For the assistance of the young astronomer, this second division of celestial bodies may be separated into four classes:—attention being especially directed, to the *respective multitudes,—magnitudes, —and relative distances,* of the celestial bodies, appertaining to each class.

## TABLE

### OF THE CLASSES APPERTAINING TO DIVISION THE SECOND.

1st.—Celestial bodies, whose comparative vicinity to our solar system, renders them visible to the naked eye, appearing to it, as distinct stars of various magnitudes and splendour.

2nd.—Celestial bodies, whose further remoteness from our solar system, presents to the unassisted eye, the appearance of light clouds: —but which, viewed through telescopes, resolve into numberless stars of various magnitudes and splendour.

3rd.—Celestial bodies, whose still further remoteness from our solar system, only allows their being seen through telescopes. Through ordinary glasses, these bodies appear as a faint solitary star.

4th.—Groups or shoals, of divers forms and sizes, occupying regions of space so infinitely remote, as only to be discernable through very superior telescopes, and *that* in the fashion of light clouds or vapours;—but a multitude of which, become resolvable, by still higher magnifying powers, into numerous clusters of stars, while others, even by the strongest powers hitherto known, only exhibit one, or at most two or three, luminous bodies, as appertaining to them.

## CLASS THE FIRST.

### CELESTIAL BODIES, WHOSE COMPARATIVE VICINITY TO OUR SOLAR SYSTEM RENDERS THEM VISIBLE TO THE NAKED EYE, APPEARING TO IT, AS DISTINCT STARS OF VARIOUS MAGNITUDE AND SPLENDOUR.

THE Stars of this class, are those everywhere beheld in a clear evening illuminating our hemisphere. Stars of this class are distinguishable from planets;

1st.—By their superior brightness.

2nd.—By exhibiting the appearance of what is called twinkling.

3rd.—From never, like the planets, changing their relative situations towards each other. The rotation on her axis, of the Earth, from west to east, causes the deceptive appearance of a daily motion of the heavens in a contrary direction; but any two stars, selected for observation throughout every interval of time, have always been found *preserving their relative distances.*

We will *preface* what further we offer, relative to this first class of stars, by a few general remarks.

The Stars,—so far from being placed on one concave surface, everywhere equally distant, are dispersed in countless directions throughout unlimited space:—and as great remoteness may exist between *any two apparently neighbouring* stars,—as between our own Sun, and the star nearest to him. Hence, an observer placed near any one of the apparently neighbouring stars, would consider the star he was near, as the only real Sun:—and all the other stars, as mere shining points.

Here it must be observed, that although the stars contained in this, (the first) class,—may be deemed comparatively near to our observation; yet the immense distance of each particular star from all the others, and especially from the Earth,—is of all considerations, the fittest for exalting our ideas of the sublimity of the universe:—For example,—the distance from the star nearest to the Earth—Sirius,—is 80,000 times that of the Earth from the Sun,—and 40,000 times that of the Earth's orbit.—A distance so vast, that although at one period of her annual course round the Sun, *the Earth is* 195 *millions of miles* nearer this star, than when she is at the opposite part of it, this immense difference in distance, causes none, in the apparent magnitude of the star.

In further illustration of the immensity of stellar distances, it may be stated, that light, which passes from the Sun to the Earth, in about eight minutes, takes nearly a year and a quarter, in coming from Sirius to the Earth:—and more than six years, in travelling to the Earth, from the *star Gamma, of Draco*:—and likewise, that a cannon ball, which moves at the rate of 20 miles a minute,—would not traverse the distance from us to Sirius, in a shorter period, than one million one hundred and twenty-eight thousand years!

Precision relative to the *magnitude* of these mighty luminaries, remains for the demonstration of future ages. But although telescopes have not yet accomplished this desired accuracy, they have attained sufficient excellence to demonstrate the stars, generally, to be equal to our own Sun in diameter; many amongst them, to surpass him, both in size and splendour; and all of them, like our Sun, to diffuse around them, their own *individual and native* effulgence.

The number of stars visible to the naked eye, is computed to be 3,000:—although only about 1,000 may be seen from the same spot at once.

It having proved impossible to furnish distinct names for all, the very earliest astronomical ages found it expedient, to devise a method, both for distinguishing the principal Stars, and ascertaining their relative positions. This the ancients attempted, by portioning out, what they called "the firmament," into imaginary figures of birds, beasts, fishes, heroes, &c. &c. called constellations, and pointing out the place of any particular star, within its assigned constellation, as the "Bull's eye,"—the "Lion's heart,"—the "Dog's nose," &c.

This division of the heavenly bodies into constellations is very ancient. Some of them are mentioned by Hesiod and Homer, both of whom, flourished 1,000 years before Christ. They are likewise named in the prophecy of Amos, 800 years before Christ.

As the knowledge of the stars extended, the number of the constellations increased; more stars were introduced into such original ones, as their positions warranted; and the names of some illustrious personages were immortalized, by being bestowed on the principal stars; as Sirius, Aldebran, Arcturus, Orion, Regulus, Ptolemy, &c.

Ptolemy, in the sequence of his age, set down the latitudes and longitudes of more than 1,000 stars.

The first considerable modern improvements in the catalogue of stars, were made by Tycho Brahe, a noble Dane, and by Bayer.

Since the time of the latter, astronomers have rendered the distinction of stars more express, by affixing, to each star of every constellation, the name of one of the letters of the Greek or Roman alphabets. For example, setting the first Greek letter, for the principal star in each constellation, as $\alpha$, alpha,—the second letter, $\beta$, beta,—to the second sized star in it; and so on, according to the magnitude and sequence. When the Greek alphabet was exhausted, the other stars in each constellation, were marked by the successive letters of the Roman alphabet; and when both were exhausted, the remaining stars of each constellation were distinguished, by ordinary numbers, in respective succession, retaining besides, the ancient appellation of the very largest stars, such as Regulus, Capella, &c.

Stars are likewise divided into classes (according to their respective sizes) called *magnitudes*—the largest being stars of the first magnitude,—up to stars of the sixth magnitude. Stars beyond the sixth magnitude, are not visible to ordinary vision.

Geographers having divided the circumference of the Earth into 360 parts, or degrees, astronomers have imagined a corresponding division of 360 degrees in the circumference of that portion of space, every where surrounding our solar system; and, as by the division of the Earth's globe into degrees, the position of each country on her surface, is expressed, so, from the division of the celestial circle into degrees, may be ascertained, *that* of each constellation. Each star visible to man, named, and numbered, is therefore, registered, in its proper constellation. Each,—*and all;*—*one* Star,—ONE STAR ALONE, *excepted*,—and *that Star*, is THE *Star*, denominated "OUR OWN SUN!"—Behold, the comparative insignificance of human knowledge! Behold, the *nothingness of its capacity!* It can demonstrate the longitude, it can ascertain the latitude in space, of every Sun within its perception—but it is ignorant, it cannot *even conjecture*, WHEREABOUTS IS ITS OWN!

A familiar explanation will be here attempted, of the mode by which the inhabitants of the Earth are admitted to the spectacle of the celestial glories around them.

Each of the Earth's two poles, constantly points towards its own spot in space; namely, the northern pole, towards one particular star in the constellation of the Little Bear, and the southern pole, towards one, in that of the Cross. From the corresponding divisions of the earthly, and celestial circles, (or circumferences) into 360 degrees each, it follows, that the distance from any one specific point in the horizon,* around by the zenith,† to the point opposite in the horizon, comprehends a supposed space of 180 degrees; consequently, from each such specific point on the horizon, to its zenith, is comprehended the distance of 90 degrees. Wheresoever therefore, a spectator is stationed on the Earth's surface, he beholds the presumed space of 180 degrees of the heavens, and no more:—all above the horizon, being visible to him, and all below it, invisible.

Hence we perceive, that the relative distance of the two polar stars being 180 degrees, and each of the Earth's poles, pointing towards its own express polar star, it follows,

1st.—That both the polar stars must be visible, nightly, *on opposite sides of the horizon*, to inhabitants on the immediate line of the Equator.*

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* The horizon, is the line all around, where the sky and the earth seem to meet.

† The zenith is the point directly over head—90 degrees from the horizon, on every side.

2dly.—That on travelling only one degree on either side of this line, these inhabitants *must lose sight* of the polar star on the horizon from whence *they diverge;* while the polar star on the opposite side, and towards which they approach, must *thereby gain one degree of elevation.*

But, while the Earth's two poles thus maintain their aspects towards their respective polar stars, it must be especially remembered, that the *daily rotation of the Earth,* is performed, *on a line diverging* 23 *and half degrees* from the poles of each of her hemispheres. This line of rotation on her axis therefore, carries every spot on the Earth's surface, in the space of 24 hours, towards all the luminaries comprised within a large portion of the celestial circle.

To render this plainer, let us take any one point on either of the Earth's hemispheres; (although comparatively, that point be less than a particle amidst infinitude) and imagining a spectator thereon, let us attend him during one Earthly rotation.

As long as this particular point continues sufficiently turned towards the Sun to receive his rays,—(in other words, as it is "*daylight*" upon this spot,)—the comparative vicinity of the Sun, excludes from it, the sight of every surrounding luminary—or star. But, no sooner does the *eastward rotation* of the Earth, carry the *eastern horizon* sufficiently *downward*, for this spot to become shrouded from solar rays by the globular form of the Earth, than our spectator begins faintly to discern, and gradually in full brightness to survey, multitudes of luminaries,—called stars,—dispersed throughout the succession of horizons, amidst which, his point of survey is about revolving;—because, in consequence of the Earth's eastward rotation on her axis, this particular spot on her surface, must necessarily continue *progressively descending* towards the successive mazes of orbs, beneath which, our spectator is to be carried.

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* The equator—the line around the circumference of any globe; and which is equally distant from each of the globes two poles.

While our aerial voyager sails amidst "Worlds on Worlds," penetrating every moment into fresh regions of space, and turning far from the beams of his own Sun,—is there nothing to cheer by former recollections?—nothing, to prove *not wandering beyond native solar influence?* Yes! the spectator turns his gaze, and beholds in the grandeur of immutability, the polar star of his particular hemisphere. His own position towards that orb has changed. Our spectator has arrived (we will say) at the nadir* of his planetary course, and stands the actual *antipodes of himself*, according to his position towards the zenith, *at its commencement.* During the autumnal months of this, the northern hemisphere for example, our spectator beheld, at *that commencement,* the polar star in the northern part of the heavens, a little above midway between the horizon and zenith:—with the Great Bear's Tail,—the Pointers, &c., shining *westwardly below its altitude;* the Pointers, pointing east south-easterly towards it. At the present, the lowest, term of the rotation, our spectator beholds the same single star in its station:—but the attendant splendours of the Bear's Tail,—Pointers, &c., *where are they?* Behold *them* irradiating the present actual zenith of our spectator;—the Pointers, pointing northwardly towards it. During the intervening hours, the Earth's eastward rotation has carried the spectator half round the polar point; and his position has become *westward,* and far *below* the mighty crescent of the Bear's Tail; but it is himself and his own little spot, together with his own entire planet, that have moved:—the sacredness of relative mutability, ever crowning the polar stars of the earth.

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* Nadir—the point in the heavens opposite to the zenith, and directly under our feet.

The nadir point accomplished, *the upward rotatory course commences,* carrying our spectator beneath fresh, and opposite regions of space, whose horizons everywhere extending 180 degrees, are everywhere emblazoned with zeniths, replete like themselves, with starry hosts;—rivals in magnificence, to those of the *downward course.* At length, the fading lustre of surrounding luminaries, announces sufficient rotatory elevation, for perception of solar vicinity; although the Earth's globular form shrouds our spectator from its rays. And now,—behold a glimpse of the "zodiacal light!"—that effluvia of magnetic electricity,—that benignant afflux,—that harbinger of solar beneficence! —behold its milky whiteness, fraught with regenerative vitality;—behold it diffusing its essence, and scattering itself in space, *far*, *far*, beyond the limits of *grosser sunbeams!* And still as our spectator upwardly rotates, behold this mighty arch expanding and expanding;—its whiteness, brightening and brightening,—now kindling,—now vivifying,—(bright portal of still shrouded illumination),—and see! increased ascent carrying him within *solar rays!* At first, faintly tinted,—then illuminated,—then irradiated! *Suddenly*, they *preponderate!* The surrounding luminaries! *Where are they?*—VANISHED!!—*Shut out, by accumulating splendours!!*. Now, behold our spectator's rapid rotation carrying him towards fresh streams of radiance:—his horizon, ascending still higher and higher,—when lo! behold it revolve on a full flood of glory,—and bear him aloft towards the Sun's mighty orb,—immersing itself, in a *tide of effulgence!*

It is now daylight again, at our spectator's *spot*, —its ceaseless rotation bearing him along, still upwards and upwards, from the first horizontal display of the Sun, through the most elevated portion of its career:—cheered, as is *this part of it*, by oblique, or morning rays. Speedily, the completion of the upward course, is apparent. Our spectator,—with the Sun at his zenith,—is about passing its vertical beam! See! the beam has been shot,—the *emanation*, in meridianal completeness, *right downward been showered!* but that completeness is gone,—that *right downward*, been passed!—Ere the word was pronounced,—the propelling thought formed,—the spectator and spot had rolled rapidly on!—the *termination* of the *upward, recommencing the downward rotation!*

Encreasing obliquity of rays, ere long, announces the rapidity *of that descending course;*—until its velocity conveys our spectator and his point of observation, beneath the precise zenith, whence, 24 hours previously, the descent of his eastward horizon, first commenced unfolding the glories of infinitude.

Thus, it is not from the "rising of the stars" above the Earth's horizon,—but from *the rotatory descent of that horizon, beneath those luminaries*, which produces their exhibition to the inhabitants of the Earth:—and thus, when the Sun appears to us, "to be rising,"—it is, in fact, the spot on which we rest, that has obtained *efficient elevation to behold his orb;*—or, when he appears "to set,"—or "go down,"—it is our horizon, that descends *out of view of him:* since it is ourselves, on our own little planet, that rise, or set, and not the majesty of the central propeller of our planetary system, that keeps spinning about, like a mountebank's toy.

So much, for the celestial spectacle afforded by the Earth's diurnal rotation. We now proceed to the more expanded one, of her annual course round the Sun.

Nature's laws, *ever act analogously, whether on a larger, or a smaller scale.* We shall find the Earth's solar revolution, exemplifying this position, by its close affinity to the Moon's revolution round the Earth;—and both illustrating the universality of *oscillatory rotation.*

Here we must recall to recollection,—

First.—That the entire circumference of the heavens, (everywhere as we know, surrounding our solar system), has long been astronomically divided into two portions, by an imaginary line, called "the celestial ecliptic;" these two portions are denominated, the northern hemisphere, and the southern hemisphere, in reference to their respective positions either over, or under, that ecliptical line:—the entire circumference of this line of division (the celestial ecliptic) being divided into 360 parts or degrees,—in both instances, a numerical conformity with the divisions of the terrestrial ecliptical line, having been observed.

Secondly.—That this celestial line of division, passes through divers portions of 12 remarkable constellations, called "the signs of the zodiac;" and that it is along a circumscribing zone, comprising nine degrees on either side of this celestial ecliptic, that the annual courses of the Earth, and the other planets, are accomplished; each planet, in its solar course, systematically diverging in *minute specific distances on either side of this celestial ecliptic;* but none of them straying beyond those specific distances:—in like manner, as the Moon's courses are circumscribed within a similar zone, of five degrees eight minutes forty-eight seconds, on either side of the Earth's ecliptical line.

Thirdly.—We find the revolutions of the Earth round the Sun, like those of all the other ten planets, and of the Moon around *herself*, to be carried on *by a succession of spiral courses—each distinct series of which, carries the Earth onward* in her solar revolutions, in orbits, diverging from one specific boundary o the celestial zone, towards her specific opposite boundary of divergence;—which last boundary attained, a fresh series of courses commences, reconducting, as it were, the Earth towards the former boundary of divergence; and so on, in double series, *ad infinitum*—in conformity with the like double series of oscillatory rotations—heretofore noticed in the Moon's Earthly revolutions.

Fourthly.—We find the Earth, in each of her annual solar courses, crossing the celestial ecliptic, *twice*—as the Moon, in each of *her* earthly courses, does the terrestrial one. These periodical crossings by the Earth of the celestial ecliptic, are at the period of the Earth's equinoxes;—the ascending, or vernal one, being from the southern to the northern hemisphere;—and the descending, or autumnal one, from the northern to the southern hemisphere;—in like manner, as the Moon's periodical crossings of the terrestrial ecliptic—(called "the Moon's nodes")—are accomplished, the ascending or increasing node, from the Earth's southern, towards her northern hemisphere, and the descending or decreasing node, from the northern to the southern hemisphere.

Fifthly.—We find a prolongation in the Earth's solar revolutions, in consequence of the *acknowledged*, although to human perception, *invisible, course of our Sun, his august self, around the centre of the Universe.* A prolongation in the Earth's orbit round him, somewhat *retarding* her arrival at each equinoctial crossing point of the celestial ecliptic, within the given point and period; and invariably causing each crossing point to be attained a small portion *short*, of the previous one: in like manner, as from similar operations, each lunar crossing point of the terrestrial ecliptic, is accomplished somewhat short of the preceding one:—and the Earth, we consequently find LOSING GROUND, as it were, in each of her annual solar circuits, to the amount of 50 seconds and a fraction:—as the Moon does, in her crossing points, to the daily amount of 3 minutes 10 seconds.*

Sixthly.—We find this minute, annual retrogradation in the Earth's equinoctial crossing points, absolutely *carrying them round the entire celestial ecliptic* in the period of 25,868 years:—in like manner, as a similar retrogradation, carries the lunar crossing points round the terrestrial ecliptic, in the period of 29 years and a fraction.

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* Causing thereby, the alternate hemispheric reproductiveness, adverted to in the account of the revolution of our own planet,—the Earth's perihelion point, in 20,931 years.

Hence, the regular, the progressive evolutions of the tropical and polar climates, around the Earth's planet. Hence, the elucidation of what the short-sightedness of man, regards as a mystery, but which, to orders of higher intelligence, exhibits the *simple mechanical consequence* of a mutation essential to planetary renovation;—namely, the *heterogeneousness of fossil remains, wheresoever found.* From that *oscillatory rotation*, by which, every *mode of earthly climate* is found revolving throughout *every spot of terrestrial surface*, it necessarily follows, that, in the course of many thousand years, the *specific modes of life*, with the means of sustenance and comfort, *appertaining to each express mode of climate*, must *successively*, have FOUND ABODE THROUGHOUT EVERY PORTION OF THE EARTH. Hence, the fossil stunted mosses of a former arctic circle,* found scattered below the rudundancy of the actual tropics;† and a few feet beneath the barrenness of the polar regions, the present fossil‡ remains of gigantic tenants,§ which, in ages unknown to record, must have sported on those very spots, amidst the exuberance of spontaneous vegetation; since, through the combined revolutions of the perihelion and equinoctial points, in the very latitude wherein the *Laplander* of *our day*, buries himself within the Earth's recesses, for warmth,—the inhabitants of its *remote generations*, were wont to luxuriate beneath the loftiness of tropical foliage.

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* Arctic circle—Regions surrounding the North Pole.

† Tropics—Regions surrounding each side of the Earth's equator.

‡ Fossils—Bodies buried within the Earth from remote ages.

§ Gigantic tenants—Mammoths—their height is estimated at 15 or 18 feet. Mastoders of nearly equal size, with lions, tigers, and other species belonging to the torrid zone.

Seventhly.—We find the general revolution of the Earth's equinoctial crossing points around the celestial ecliptic, causing a corresponding mutation in the inclination of her poles. The bright star in the Lesser Bear, the *present Earthly* "*North Pole Star*,"—(to use the words of Sir John Herschel)—"has *not been always*, nor will always continue to be *regarded as such*."

When the earliest present astronomical catalogues were constructed, the Earth's northern pole, pointed 12 degrees wide of this star:—at present, it points within 1 degree, 24 minutes of it; and this inclination towards it, will increase, until within half a degree of it. Afterwards the pole will gradually and slowly, commence *receding from its inclination towards this star;* pointing, in its stead, towards other stars, contained within the minute circle of polar revolution, and each of *them*, becoming in succession, the polar star of the *generations then inhabiting this planet;*—until at length, after a lapse of 12 thousand years (that is, at the accomplishment of HALF THE REVOLUTION of the *equinoctial ecliptical* crossing points)—the inclination of the Earth's pole, will point within five degrees of the *Alpha star in Lyra*. That star, the brightest in the northern hemisphere, having become, during this period, the northern polar star of the Earth:—*thus*, to remain, until the same vibratory operation, though in contrary divergence, *reconducts* the polar inclination *towards our present unerring guide, the bright star of the Lesser Bear;* exhibiting, every 25,868 years, a magnificent manifestation of the never-varying principle, upon which, rests the stability even of infinitude—namely, "OSCILLATORY ROTATION."

In like manner, as during the nocturnal part of his rotation, our spectator found himself surrounded by luminaries, so, during the Earth's course round the Sun, twelve especial groups, called constellations, are to be distinguished. These constellations are "the twelve signs of the zodiac;"—which, while maintaining their relative immutability,—irradiate a zone, comprising nine degrees on each side of the *celestial ecliptic*. *That path around the Sun, of the solar planets.*

Although these groups, or constellations of stars, are of various magnitudes, both as to numbers of orbs, and portions of space occupied by them; yet astronomers divide each of these signs, into thirty portions, called "degrees;"—and therefore, *such* shall be the division in what follows.

It takes the Earth about a month, to pass along one sign, (thus astronomically divided into thirty of these "degrees,") according to the rate of 64 thousand miles an hour, at which she travels in her annual course around the Sun;—the Sun being placed, as we know, towards the centre of the Earth's circuit around himself. The space along the first of these signs being accomplished, the Earth proceeds, in her circular course, towards, and along another; and so on, in succession, throughout the whole twelve.—At the end of the last, and as she is about recommencing progress along the first sign, the lustre *at the zenith*, *of the same star which illuminated her departure from thence*, 365 *days and a fraction previously*, announces the termination of one of the Earth's annual revolutions around the globe of the Sun.

As the Earth thus travels with the Sun, around which she is moving, on one hand,—and the sign along which she is passing, on the other,—it necessarily follows, that whichsoever of the *other* 12 signs, is, at any given moment, diametrically opposite the sign along which the Earth is actually moving, that sign it is, which, as regards the Earth's position, then becomes the one precisely on the contrary side of,—or behind,—the Sun;—although both Sun and sign, have remained stationary. The fact,—that a like succession of scenery,—provided that scenery be at once circular and stationary,—will be viewed as successively developing itself around the radiance of *a central and large luminous body*, by any smaller body, revolving *within* such circular stationary scenery, and *around* such central stationary body,—this fact, is self evident,—constituting a primary law, both of science and common sense. Here surprise must be expressed, at the retention of such perplexing terms, as "the Sun's course through the zodiac;"—"the Sun's entering into, or quitting such, or such a sign," &c. Terms, fraught with confusion to the ignorant, and, as long as astronomical works employ them, creating great increase of difficulty: since it is in the VERY FACE OF SUCH BEWILDERING EXPRESSIONS, that we have to make the youthful enquirer apprehend, that it is the Earth, *in fact*,—and *not* the Sun, that moves *along* the zodiacal circle; consequently, that it is the Earth, which enters into, and travels along each particular sign, and *not* the Sun; *that sign* too, being the one *invariably opposite the actual sign* set down in almanacks, as the sign entered into, or travelled along by the Sun.

The steadfastness of the polar aspects throughout the whole of the Earth's rotations, invariably exclude the inhabitants of each of her hemispheres from the celestial wonders of the opposite one, immersed in the solar effulgence of day *when over their head*, as that opposite hemisphere must be. Human vision on each hemisphere is therefore, confined to its *own nocturnal* succession of stars; and these luminaries are denominated, according to their respective hemispheres,—"Stars of the northern hemisphere,"—or, "Stars of the southern hemisphere."

We now proceed to advert on the first class of stars:—namely, *stars visible to the naked eye.*—These are 3,000 in number, and may be separated into two portions:—namely,

1st.—Those retaining singleness of globe, under every observation,—or, "*single stars.*"

2nd.—Those appearing single stars to the naked eye, but proving, by ordinary glasses, to consist in numerous instances, of two, in various others, of three—four;—in some, of even many stars. These stars are called—"double stars."

The first of these stellar divisions, is continually decreasing in number. Such is the infinity of space, that the finer the telescope, the larger is the number of stars, becoming resolved into plurality.

## PORTION I.—CLASS THE FIRST.

# SINGLE STARS.

THE diversity in the magnitude of Stars, amongst other causes, may originate, from the inequality of their distances from us,—from actual difference in size,—or, from a union of both causes:—but in many instances, it arises from that approximation of two or more stars, which has obliged us to separate all stars visible to the naked eye, into the above two divisions.

The major portion of these 3,000 beautiful orbs may, however, unhesitatingly be pronounced "*single stars;*" no glasses being sufficiently powerful to break their majestic unity. Amongst such splendid luminaries, may be ranked Sirius, Arcturus, Aldebaran, Capella, Lyra, &c. &c., each of them, the Sun of his own particular system. Some of these Suns, far surpass our own, in their magnitudes;—as for example, Sirius, whose diameter is calculated to be *seven times greater than that* of our Sun; and these Suns especially are presumed to transcend our own, *in the multiplicity of their attendant planets*, with *their* attendant *Moons.*

About the beginning of October, in this portion of the northern hemisphere, early in an evening, the grandest of all possible triangles, may be seen, as formed by the superb stars of, Arcturus towards the west,—Capella towards the north-north east,—and Lyra in the zenith. This spectacle, strikingly exhibits the majesty of *three glorious luminaries*, in full rivalry of splendour; each of them, the soul-sustaining source of life, to a host of rejoicing, sentient beings, dispersed among the beauteous PLANETS, whose appointed courses, are ever circling around the individual Sun, of their specific system. Planets—rendered by remoteness, as *invisible to us*, as are to *them*, our own splendid ones; and from whose orbs, our *own entire solar system*, like *each of theirs* to us, PRESENTS BUT A SINGLE POINT;—and that point, *our own benignant Sun*;—the rival in effulgence and beneficence, to each of these other three mighty sources of life, light, and heat:—the Arcturus,—the Capella,—and the Lyra of their respective and glorious systems.

A winter evening, presents in our hemisphere, the grandest assemblage of heavenly bodies. During one of them, the student will gain more information from an hour's contemplation of the *relative stations of these, towards the polar star*, than from a thousand closet lectures.

"In England," says an intelligent writer, "the polar star is always to be looked for in the northern part of the heavens, rather above midway between the horizon and the zenith.

"Under this aspect of the heavens, two stars are found on the eastern side in a right line to the polar star. They are six degrees asunder, and the nearest, is five times that space (or 30 degrees) from the polar star, towards which they appear to point; and thence they are called 'The Pointers.'

"At such an hour, the other remarkable objects will be, the Pleiades, or Seven Stars, in the south-east, and below them, a little to the east, the grand constellation of Orion, and still lower, the dog star, Sirius, the brightest of all the fixed stars. The three bright stars together in a line, called the belt of Orion, are at about equal distances from the Pleiades and Sirius; that is, about twenty-five degrees from each.

"Besides remembering this distance, and that of the Pointers, before-mentioned, for the sake of occasional comparisons of distances, it will be useful to recollect, that the most northern of the three stars in the belt of Orion, is exactly over the equator; so that from that star, to the north pole star, is exactly ninety degrees.

"The Pleiades are in the zodiac,* on the southern side; and so is the red star Aldebran, which is near them. The two bright stars, about forty degrees to the left, called Castor and Pollux, or the Twins, are also in the zodiac."

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* Zodiac—see page 140.

" About five degrees north of the Twins, is the point in the zodiac, diametrically opposite to that point in the zodiac attained by this planet,—the Earth,—on the 12th of July. On that day consequently, this point appears to the inhabitants of the Earth, exactly behind the position of the Sun towards them."

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## THE NUMBERS AND MAGNITUDES OF STARS VISIBLE TO THE NAKED EYE.

| | | MAGNITUDES. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. | Total No. |
| Constellations in the zodiac ............ | 12 | 5 | 16 | 44 | 120 | 183 | 646 | 1014 |
| Constellations in the northern hemisphere ............ | 33 | 6 | 24 | 95 | 200 | 291 | 635 | 1251 |
| Consteilations in the southern hemisphere ............ | 45 | 9 | 36 | 84 | 190 | 221 | 323 | 865 |
| | | 20 | 76 | 223 | 512 | 695 | 1604 | 3130 |

# THE ZODIAC.

THE ZODIAC, is that zone in the heavens, lying nine degrees on each side of the celestial ecliptic, within which 12 constellations are comprised, called "*the signs of the zodiac.*" It is along these 12 signs, that the annual courses round the Sun, of the Earth and the other ten larger planets of our solar system, are comprehended.—None of these planets diverge far from the line of this celestial ecliptic, (or middle of this zone), although each of them crosses it *twice*, in its annual course at *opposite points of it*, causing thereby, the alternation of summer and winter to its opposite hemispheres. The points of intersection are called "the equinoctial points;" their periods are determined, by that of each planet's solar revolution. Hence in Mercury, these intersections occur in a period of 44 days;—with Herschel in one of 42 years, 12 days, and 12 hours.

# SIGNS OF THE ZODIAC.

| | | Numbers and Magnitudes. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Names of signs. | Names of principal stars. | 1st. | 2nd. | 3rd. | 4th. | 5th. | 6th. | total no. |
| Aries......... | Aries.................. | | 1 | 2 | rest smaller | | | |
| Taurus...... | Aldebran ............ | 1 | 1 | 4 | rest smaller | | | 141 |
| Gemini...... | Castor & Pollux... | 1 | 2 | 5 | rest smaller | | | 85 |
| Cancer ..... | | | | 1 | 3 | rest smaller | | 83 |
| Leo ........ | Regulus ............ | 1 | 3 | 4 | rest smaller | | | 95 |
| Virgo ...... | Spica Virginis ... | 1 | | 6 | rest smaller | | | 110 |
| Libra ...... | Zubenich Mali ... | | 2 | rest smaller | | | | 51 |
| Scorpio...... | Antares ............ | 1 | 1 | 5 | rest smaller | | | 44 |
| Sagittarius | | | | 5 | rest smaller | | | 69 |
| Capricorn... | | | | 2 | rest smaller | | | 51 |
| Acquarius... | Scheat ............... | | | 4 | rest smaller | | | 108 |
| Pisces ...... | | none exceeding 4th mag. | | | | | | 113 |

## SCALE OF DIVERGING DISTANCES OF SIXTY MILES WITHIN OUR SOLAR SYSTEM.

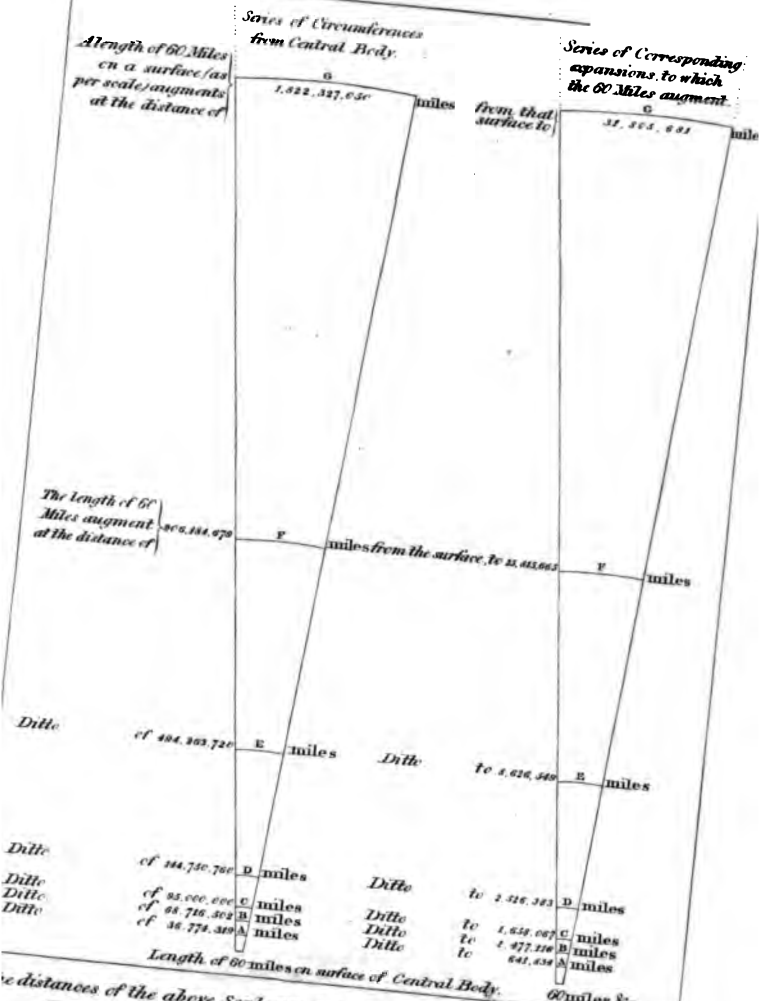
THE first step in astronomical pursuits is to expand our apprehensions of celestial computations as much as human feebleness, permits, since they regard objects whose magnitude and duration transcend just appreciation by the present limited faculties of man.

The application of the term "degree" in the division of the celestial ecliptic, into 360 portions, is therefore to be regretted, as somewhat perplexing to the uninitiated in astronomy. They find the Earth's circumference to be divided in a similar manner into 360 degrees, and the geographical degree to comprise 60 miles, while nothing definite is stated of the extent of the celestial degree. The term degree, employed in positions so dissimilar, occasions mental confusion prejudicial to expansive apprehension of celestial machinery.

Some faint idea of the immensity of space, comprehended by the term degree, when applied to celestial distances, (even within the limits of our solar system), may perhaps be afforded by a scale, displaying the diverging angles of 60 miles as subtended from the surface of a circular body 7,970 miles in diameter, towards a circumference 1,821,880,050 miles distant, the diverging angles passing through a series of circumferences, whereof that circular body forms the common centre, and the progressive augmentation of miles, to which the angles of the original 60 miles diverge at each circumference, being duly marked.

When we behold to what a magnitude the angles of, comparatively, so dimunitive a particle in space, as 60 miles, subtend within a system, which *in itself*, forms but a particle amidst creation; somewhat of expansion, may attend our contemplation on the awful grandeur of infinitude. !

*A Scale of expansions corresponding to a length of 60 Miles on the surfac*
*of a Central Body 7970 Miles in diameter as comprised within a circumference*
*of 1,822,327,050 Miles from that Centre.*



*e distances of the above Scale, are taken from our own Sun's Planetary System*

**Diameter of supposed Central Body 7970 miles.**

*pposed position of supposed Central Body, calculated from the Sun's Centre*

ercury. B.Venus. C.Earth. D.Mars. E.Jupiter. F.Saturn. G.Herscl

## PORTION II.—CLASS THE FIRST.

# DOUBLE STARS.

THE most prominent to superficial observers, in this division, are various stars, to unassisted vision, of considerable size, but which viewed through glasses, are frequently found to consist of two distinct orbs; and often of three, four, five, nay occasionally, of small groups of stars; the immensity of their distance from the Earth, blending their radiances, and to ordinary vision, concentrating them into one luminous body, or "single star;" although each of them shines individually, and in fullness of innate splendour, THE EFFULGENT SUN of his entire planetary system, myriads of miles from every one of the others! *Such* is the scale of immensity!—Such the magnificence of infinitude!!

Of *resolvable* stars, thus appearing single to the naked eye, Herschel made a catalogue many years ago, amounting to 269: and the diligence of science has already augmented it to 500; many stars, formerly considered of the first magnitude, appearing therein.

Herschel's powerful glasses, having thus resolved many stars into double, treble, quadruple, &c. &c. and even into multiple, (as in the instance, for example, of the star in the sword of the constellation of Orion,) he subsequently divided them into classes, according to their *relative distances;* those closest to each other, forming the first class, &c.—Of these, the first 24 require a superior telescope, and clear atmosphere, to render their separation visible at all:—38 are proper for estimation by the eye, though very approximate: 46 are from 5 to 15 seconds, asunder:—44, are from 15 to 30 seconds asunder:—51, from 30 seconds to one minute:—and 66, from one minute to two minutes asunder.

This series of observations, forms the first step towards the astounding vitality of space, and therefore demands close attention.

It is amidst such *resolvable,—or double stars,* that our celebrated countryman, Sir William Herschel, (the discoverer of the planet Herschel), ascertained from a series of 25 years' observations, the existence of *binary stars:* or, of stars approximating towards, or revolving around, each other. He thereby, manifested *two distinct classes,* into which, all double or resolvable stars, may be divided. A discovery which would alone immortalize that truly great man. It was announced to the Royal

Society in the year 1803, and the accumulated labours of astronomers have, ever since, illustrated its accuracy.

"Double stars" are now, therefore, divided into,

1st.—Stars of independent systems,—and
2nd.—Binary stars.

## STARS OF INDEPENDENT SYSTEMS.

Many globes, perhaps myriads of miles distant from each other, are nevertheless, so relatively stationed toward us in their remote regions of space, that, from the minuteness of the angle of their apparent distance as *viewed from the earth*, good glasses are requisite to render their separation visible. The more powerful the instrument, the more decided, will become the angle of that visible separation.

In consequence of this immediate approximation, a series of observations, from divers portions of the Earth's annual course round the Sun, is often necessary (and *that* too, through a succession of those annual courses) before the invariableness of the angle of distance is sufficiently demonstrated, to prove the *specific relative independence of the orbs*, into which, some of the double stars may be resolved. But, when any bodies, from whatsoever portion of a circle they may be seen, *invariably maintain the same relative positions and distances*, they may be pronounced as *not* revolving round one another.

In some cases, these approximated stars are found of equal sizes:—but generally, one appears much smaller than the other, as though far, far, behind the larger one in remoteness. Although varying in splendour, they generally are of the same bright colour.

## BINARY STARS.

Sir William Herschel perceived with no small surprise, during a long series of observations on double stars, a VARIATION OF POSITION, among many of them. To these he devoted his peculiar attention; until in various instances, he distinctly ascertained the revolution of one of them, around the other.

The class of resolvable bodies denominated "Binary Stars," exhibit a powerfully interesting study to finite capacities, and must prove an inexhaustible source of astronomical improvement, exemplifying as it does, in *remote regions of space*, our own planetary laws of *periodical revolution*, on a scale awfully impressive.

Here let it be remarked, that we are not contemplating, in the revolutions of binary stars, the movements of mere planets;—(stupendous as are these) but, are admitted to the august spectacle of one Sun, revolving round another Sun, in periods, appalling in magnitude, though precise in duration; each of these mighty orbs being attended by *the undescribable majesty of its own entire system of* *revolving planets, and their respectively revolving satellites!* The man, whose consummate optical skill, first endowed instruments with power to trace, and whose indefatigable perseverance afforded him science to record, celestial movements of magnitudes thus awful, is in truth, *a glory to his age;*—and, when the names of its little ephemeral heroes shall be lost, as though a Wellington, or a Nicolas had never existed, that of HERSCHEL shall endure, as long as man continues to be a race.

The number of binary stars, whose motions are already ascertained, amounts to more than 40: each accession of science, containing its augmentation. In some instances, two of these binary luminaries are found revolving round a common centre of gravity; in others, the smaller orb revolves round the larger. Most binary systems exhibit beautiful phenomena of contrasted or complimentary colours: as for instance, the larger star, is usually of a ruddy or orange hue; while the smaller one, appears blue or green:—but when the larger star is the less bright of the two, the other will evince peculiar lustre; as for instance, the (η) of Cassiopeia, a remarkable double star, which presents the beautiful combination of a large white star with a small rich purple one. The combinations of the hues of green and blue found among some binary stars, are still more remarkable; since, although insulated stars of a red colour occur, nearly as deep as blood, yet no green or blue stars of decided hue, have been yet noticed, unassociated with a luminary brighter than themselves.

The ellipses, or ovals, in which stars of the binary systems revolve, are generally more elongated than the orbits of the planets. The rapidity of their evolutions in some instances, appears stupendous:—for example,

The unrivalled motion, as a planet, of Mercury, is at the rate of 107 thousand miles an hour—the perihelion velocity of the comet of 1680, was 880 thousand miles an hour: but, if the binary stars in Bootes, be as *remote from one another*, as the *nearest fixed star* is, *from our Sun*, the velocity of the revolving star is so much greater than either of those above quoted, as to exceed imagination. Besides revolving round one another, some of the binary systems are carried forward, by a motion common to both stars, towards some unknown point. As an instance of the magnitude of these binary evolutions, let us observe, that the two stars of 61 Cygni, have remained at the same distance from each other for fifty years, but have changed their place in the heavens, during that period, about four minutes and twenty-eight seconds. Their motion onwards, must appear for ages *uniform from* the Earth; because, even if their path *be curved*, the portion we see of it, being so small, as must to us appear a straight line. Multitudes of single stars, have also their motions: yet, so minute to our perception as scarcely to be observable. Nothing can more strikingly exhibit the immensity of the distance from us, of these stars, than the apparent minuteness of their motions--their evolutions being, in fact, on a scale so enormous as to transcend human conception.

Among the most remarkable of the binary systems, the following are selected :—

The star Castor, in Gemini, viewed through glasses, is resolved into two binary stars of very different magnitudes. The larger star is of a superb colour, the smaller one, of a beautiful blue hue. The revolution of the smaller star round the larger one, comprises a period of 334 years and two months.

2nd.—The star Gamma γ in Andromeda, exhibits a beautiful specimen of binary revolution. Here is beheld, a large star of a bright reddish colour, and a small one revolving round it, of a fine light green.

3rd.—The star Epsilon ε, in Bootis, resolves into one large red star, and one much smaller, of a fine light blue colour. The motion of this smaller star is elliptical, and it revolves round the larger one, in 1681 years :—consequently an inhabitant of this smaller star, who has witnessed 25 of ITS ANNUAL courses ROUND ITS PRIMARY, (the larger star) ; in other words, who has existed 25 of ITS YEARS, must have accomplished a duration of 42 thousand and twenty-five of our earthly ones ! The mind sinks beneath the contemplation of Beings, with endowments necessarily, so exalted !

4th.—The star Zeta in Hercules, exhibits the spectacle of two binary stars, very unequal in size ; the larger star, proves to be of a red colour, the smaller of a blueish green. This is esteemed a particularly beautiful exhibition. On the 11th of April, 1803, the smaller star, was nearly occulted by the larger one.

5th.—The two stars into which the double star Delta in Serpentis resolve, have undergone a considerable change in the angle of position, in the small portion of time, since telescopic improvement has admitted of double star observations. No variation of distance between them, has however been observed. Herschel computed the period of the revolution of the smaller, round the larger star, to be 375 years.

6th.—The star Gamma γ in Virginis, was among the earliest exciting astronomical observations. It is resolved into two stars of nearly equal size; the one which is somewhat the least, revolving round the other in 708 years. In the middle of the last century, these two stars, as observed by ordinary telescopes, were registered as *two distinct stars;* being then, distant about seven seconds from each other. The illumination of a Herschel, had not then arisen, and the laws relative to binary stars, were unknown. Since the beginning of the 18th century, these stars have constantly kept approaching; and at present, are hardly more than one second asunder: no telescope, therefore, unless of very superior power, can at present show them otherwise than as a single star, somewhat lengthened in one direction. This double star, has been an object of particular interest to Sir John Herschel, who has determined the form and position of the elliptical orbit of the revolving star, with extraordinary truth. According to his computation, it must have arrived at its perihelion on the 18th of August, 1834. The actual proximity of the two stars, must then have been extreme; and the apparent angular velocity, during the approach towards the primary, immense. By the laws of elliptical motion, the angular velocity of the revolving star, must now gradually diminish; till it comes to its aphelion, some 314 years hence. The satellite star of Castor, will attain its perihelion some time in the year 1855.

7th.—The star Gamma in Leonis, resolves into one large star, and one smaller one revolving round the larger one, in an elliptical orbit, in the period of 1,200 years.

8th.—The star in the left fore foot of the constellation Monocaros, most remarkably demonstrates the value of telescopic improvements. With ordinarily good glasses, it is resolved into a double star; and one of these, if very strictly attended to, may be discovered to be double, likewise; the first of them, being evidently the largest, and the whole of them, appearing of a white hue. But viewed through a telescopic power of 227, they gain a very decided distinctness, although still preserving close vicinity; and with one of 460, they present the magnificent spectacle, o. one very large star, and two other smaller luminaries.

If the periodic revolutions of some of these bodies be remarkable for length, so on the other hand, those of many binary stars are equally so for shortness of duration—as for example,

9th.—The star Algol in Perseus, is a most remarkable periodical star. It constantly appears for the space of 2 days and 14 hours, as a star of the second magnitude, when it suddenly diminishes in splendour, and in 3 hours and a half, it is reduced to a star of the fourth magnitude. It then begins to increase; and in 3 hours and a half more, is restored to its usual brightness, going through all its changes in the period of 2 days, 20 hours and 48 minutes or thereabouts.

The above remarkable fact was first ascertained by Goodrich in the year 1782; and the same phenomena have constantly continued to be observed. Sir John Herschel (the son of the genius, as well as of the parentage, of his father) suggests their being caused by the revolution, during its course round its primary, of some opaque body, which occasionally interposing between us and that primary, cuts off a considerable portion of its light, occasioning an apparent reduction in its magnitude, to our vision. " In any case, these phenomena" (says this enlightened man) " indicate a high de-" gree of ACTIVITY in regions, where but for such " evidences, we might conclude all lifeless."

Since the discovery of it by Sir William Herschel, the smaller star in Corona, has completed one revolution round the larger one, and is far advanced in another; and the smaller stars in the binary star, ξ in Ursæ, the ζ of Cancri, and the 70th of Ophiuchus, have all accomplished the largest portions of their respective courses, since the same epoch.

That of Ursæ, takes in its accomplishment, 58 years and a half: that of 70 Ophicui, near 81 years: that of Corona, 48 years and 40 days: and that of Cancri, is calculated at 55 years.

“The same evidence is now possessed of the rotation of binary stars about each other,” observes Sir J. Herschel, “that we have of those of the “planets Herschel and Saturn, about the Sun; and “the correspondence between their calculated and “observed places, in such very elongated ellipses, “must be admitted to carry with it proof of the “prevalence of the Newtonian law of gravity in “their systems, of the very same nature and co- “gency, as that of the calculated and observed “places of comets, round the central body of our “own planetary one.”

Let it be observed in this place, that the discovery of these periodic rotatory varieties, in this infant state of science, prepares the human intellect for the probable attainment, by remote generations, of the demonstration of stellar varieties on an infinitely larger scale. Increase of knowledge and experience, may enable far distant ages to reduce to *periodic rotation*, in like manner, the phenomena of those *apparently temporary stars*, appearing from time to time in different parts of the heavens;

blazing forth with extraordinary brilliancy, and, after remaining awhile apparently stationary, having died away, without a trace.

Such was the celebrated star of the year 125 before Christ:—that of A.D. 389, which remained as bright as Venus for three weeks, and then disappeared:—that of 1572, which excited astonishment in Tycho Brahe, and also that of the 10th of October, 1604, which continued visible until the following October:—with various others, equally the astonishment of the science, and the terror of the ignorance, of their periods of appearance.

## SECOND CLASS.

CELESTIAL BODIES, WHOSE FURTHER REMOTENESS FROM OUR SOLAR SYSTEM PRESENTS TO THE UNASSISTED EYE, THE APPEARANCE OF LIGHT CLOUDS; BUT WHICH VIEWED THROUGH TELESCOPES, RESOLVE INTO NUMBERLESS STARS OF VARIOUS MAGNITUDES AND SPLENDOUR.

HITHERTO we have taken a limited survey of the heavens. Comparatively, we have not wandered far, from our own abode.—Hitherto, we have only contemplated the annual beauteous courses of our own solar planets, or beheld insulated, august sources of life, motion, and heat, reigning in emulative splendour, amidst thousands, or tens of thousands, equally glorious and benignant Suns.—At most, we have witnessed, what to unassisted vision, appeared as one, and one only, of such rival orbs, resolved by telescopic aid, into two or more stupendous centres of separate systems.

Such, and such only, have been hitherto our contemplations. Contemplations, commensurate to Omnipotence in magnificence, yet comparatively, constituting *mere portals in creation.*

But at length the temple,—the Almighty temple of Creative Majesty, unfolds before us; and the awfulness of infinitude manifests itself to finite intelligence! Here, therefore, let the faculties of the writer *pause*, and in MUTE ADORATION *gather strength!*

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Amongst the striking features of the celestial prospect afforded to man by darkness, is a luminous magnificent band, stretching across the sky from horizon to horizon; and, like a mighty zone, encircling the WHOLE SPHERE. In one part of its course, a branch emanates from the main portion, and after pursuing a distinct line for about 130 degrees, reunites itself to the main body. This mighty zone is denominated "the *Milky Way.*"

The milky way constituting the Nebulæ nearest our solar system, demands peculiar attention; its wonders, being introductory to those of corresponding, but immensely remote phenomena.

"This stupendous belt," says Sir John Herschel, "has maintained, from the earliest ages, the same "relative station among the stars."

On first presenting our glasses towards this mighty zone, we are lost in amazement at the multiplicity of stars, suddenly bursting upon us in every direction of the telescopic field. "So crowded "with luminaries," says Sir John, "is this "portion of the firmament, that Sir William "Herschel, by counting the stars contained within

" the field of his telescope at one time, came to " the conclusion that 50,000 passed under his " notice, in a zone of three degrees in breadth, " during the observation of a single hour." " This " portion," (he adds further on), " when viewed " through powerful telescopes, is found (won- " derful to relate), to consist entirely of stars, " scattered by millions, *like glittering dust*, on the " back-ground of the heavens."

Three especial subjects of admiration present themselves in the regions of the milky way.

1*st.—The Classification of the Stars.*

2*nd.—The evident magnitude of the relative distances of Milky Way Stars.*

3*rd.--The immensity of their remoteness from us.*

### 1*st.—The Classification of the Stars.*

THE same division into relative magnitudes, that reigns throughout the stars of our surrounding constellations, appears amongst those of the milky way: marking, by a like gradual diminution amongst them, *in size*, the same classification into shoals of stars, upon shoals of stars, and again, the same condensation among those shoals into corresponding *stratas of stars* ,—(or range above range)—which we survey within our own, comparatively, neighbouring scenery. The whole, being crowned in the milky way sky, with similar *vapoury light clouds*, to those we behold, as Nebulæ, in our own more immediate heavens. Both mighty regions of wonders, manifesting the same creative design—the same benignant superintendence! Here it is refreshing to reflect on the harmoniousness of *that design*, as found *every where upholding the general comfort of its creatures;* while sources of higher gratification, are only opened through the enlargement of their mental energies. Thus, while by Man's physical organization the glories of his native spheres, lie expanded before his naked eye, the complete development of his intellectual faculties is required, for enabling him to penetrate beneath the wonders of the milky way sky.

There, contemplation within a *novel region*, is instantaneously recognized.—First, by the excessive minuteness of objects thus meeting the gaze from *remoteness of such immensity;*—the whole appearing through the telescope, like the long protracted exhibition of one entire miniature spectacle:—and lastly, it is demonstrated by the grouping amongst themselves, of these milky way stars. Multitudes of their constellations are superbly beautiful, and splendidly defined;—but the aspect of *none* amongst them, resembles our surrounding ones. This last diversity is *awfully striking*; plainly announcing, that NEW HEAVENS are unfolded to our view.

### *2nd.—The evident magnitude of the relative distances of Milky Way Stars.*

In attempting enumeration of the relative distance of these stars,—" imagination," says Sir John

Herschel, "is lost!!" The strength of this expression will not surprise, on considering that no accuracy can be obtained of *relative distances*, even among the stars appertaining to our own surrounding constellations, notwithstanding our comparative vicinity to them;—and, that the *stupendous increase of angular* divergencies, subtended at that *remote portion from us of the celestial circumference*, wherein the milky way regions are comprehended, *baffles any human attempt at computation*. These humble pages shall be adorned by concluding the remarks on stellar distances, in the following luminous words of Sir John Herschel.

"The only mode," says he, "we have of conceiving such intervals at all, is by the time which it would require for light to traverse them. Now light, as we know, travels at the rate of 192,000 miles a second. It would, therefore, occupy one hundred millions seconds, or upwards of three years, in such a journey at the very lowest estimate."

*3rd.—The immensity of their remoteness from us.*

"How then are we to allow for the distance of those innumerable stars of the smaller magnitudes which the telescope discloses to us! If we admit the light of a star of one magnitude to be half that of the magnitude next above it, it will follow that a star of the first magnitude will require to be removed to 362 times its original remoteness to appear no larger than is one of the sixteenth. It follows therefore that among the countless

" multitude of such stars visible in telescopes there
" must be many whose light has taken at least a
" thousand years to reach us, and that when we
" observe their places, and note their changes,
" we are, in fact, reading only their history of a
" thousand years date thus wonderfully recorded."

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The portion of the milky way most striking to Sir William Herschel, was about the head and club of Orion: the astonishing multitude of whose stars, was beyond even his skill to compute.

It is presumed that this planet, the Earth, with its entire solar system, is placed midway between the two surfaces of this starry stratum, the milky way, and near the point whence its two branches diverge.

In a clear night, various bright patches attract attention, dispersed about the heavens; all, equally resolvable into distinct stars, by glasses of more or less power. Amongst these, is the beehive in Castor;—resolvable by a common night glass into stars: also the beautiful constellation of the Pleiades, easily resolvable into a superb group of 60 large stars, crowded together into a very moderate space, and comparatively, insulated from the rest of the heaven. With stronger magnifiers, stars of smaller magnitude appear amongst these 60 larger ones.—Also, a bright spot in the sword-handle of Perseus; but which requires glasses of high power.

# THIRD CLASS.

## CELESTIAL BODIES, WHOSE STILL FURTHER REMOTENESS FROM OUR SOLAR SYSTEM ONLY ALLOWS OF THEIR BEING VISIBLE THROUGH TELESCOPES. THROUGH ORDINARY GLASSES, THESE BODIES APPEAR AS A FAINT, SOLITARY STAR.

WHEN man, amidst the wonders of space, has recourse even to ordinary glasses, he learns the diminutive scale of human perceptions, however admirable their construction.

If the field of an ordinary telescope, travels along many portions of the heavens, which, to the naked eye appear dark and uninteresting, solitary stars, of a faint dull hue, begin to cross it;—each of them, appearing as if standing alone in creation. But, let many of these seemingly insulated stars, be viewed through higher magnifying mediums, and the scene changes. They resolve into double, treble, often into various, stars; and in proportion as the magnifying power is increased, so will be found to augment the number of distinct stars.

But it is in the brighter part of the heavens, that, to this planet—the Earth,—the INFINITY OF CREATION most splendidly displays itself. Let us turn for example, towards Orion. The superb constellation of Orion, is found so redolent of these *Suns*, that good telescopes exhibit more than 2,000 luminaries, within his specific boundaries. The majority of them, in places appearing dark to the unassisted eye.

Hence, the number of telescopic stars throughout space, may be denominated *infinite*;—thousands upon thousands, every where arising to view; and according to the increase of power in the instrument, their mighty hosts augmenting in multitude, and expanding in magnificence.

# FOURTH CLASS.

GROUPS OR SHOALS OF DIVERS FORMS AND SIZES, OCCUPYING REGIONS OF SPACE SO INFINITELY REMOTE, AS ONLY TO BE DISCERNABLE THROUGH VERY SUPERIOR TELESCOPES; AND THAT, IN THE FASHION OF LIGHT CLOUDS OR VAPOURS, BUT A MULTITUDE OF WHICH, BECOME RESOLVABLE, BY STILL HIGHER MAGNIFYING POWERS, INTO NUMEROUS CLUSTERS OF STARS: WHILE OTHERS, EVEN BY THE STRONGEST POWERS HITHERTO KNOWN, ONLY EXHIBIT ONE, OR AT MOST, TWO OR THREE LUMINOUS BODIES, APPERTAINING TO THEM.

WHEN we recollect that only 227 years back, the immortal Galileo, through his matchless invention of the telescope, stood aghast at his own discovery of "Moons encircling Jupiter," the whole scientific world crowding around, to behold the generally denounced "*impossible spectacle*," and retiring lost in wonder at a manifestation of creative grandeur, presumed, by the ignorance of that day, to be unparalleled,—and when we further reflect, on the imperfect state in which telescopes were found only 60 or 70 years back, by the truly illustrious Sir William Herschel,—we shall not wonder at the prevalent ignorance respecting regions, whose remoteness, precludes inspection except by magnifiers of superior power.

Since their improvement, common sense has already taken place of Sir Isaac Newton's scheme of filling space, with voids:—and it is a rational, as well as delightful expectation, that combined improvements in optics and astronomy, may hereafter render the wonders of nebulæ as palpable to intelligence, as have already become those, of Jupiter's satellites.

The existence of an all *pervading medium*, has long been faintly discerned by common glasses. This medium is denominated nebulosity. A beautiful specimen of its diffusion throughout our solar system, is offered to the naked eye, in the "zodiacal light," visible any clear evening after twilight in April and May, and any clear morning before twilight, during the winter months in England.

From the recentness of optical improvements the laws by which nebulosity exercises its important functions, yet remain in comparative obscurity; but nebulosity, is already demonstrated to be a self luminous, material substance, pervading infinitude in an infinitely gaseous state: and in many portions of space, by the mutual gravitation of its particles, gradually subsiding into the SUNS OF FUTURE ENTIRE SYSTEMS.

Detached portions of nebulosity like the above, are called nebulæ; and may be divided into two portions, according to their apparent relative proportions of condensation.

## PORTION I.—OF CLASS THE FOURTH.

### *Nebulæ distinctly resolvable into numerous Stars.*

The foremost of these, to human apprehension, because the nearest to our planet,—the Earth,—is the nebulæ we call the milky way:—and attention must be paid, to the allusion heretofore made to this distinguished feature in our portion of the heavens:—since, although the distance of this zone from the Earth's planet be immense, yet, in proportion to all other nebulæ, its *comparative vicinity*, furnishes important insight into their natures.

Attention must therefore be especially directed to what relates to the multitude of stars, with which the milky way is crowded; and likewise, to the diversity in their relative sizes and splendours.

It was the multitude of stars discernable in the milky way, that turned the attention of Sir William Herschel to the more distant portions of the nebulous regions.

Telescopes of still stronger power, revealed the surprising fact, of *nebulæ*, corresponding with that of our milky way, being *dispersed throughout every direction of the heavens;* and exhibiting like it, strata upon strata, (or range beyond range) of *magnificent effulgences.* Some of these resolvable nebulæ equal,—some surpass, our own nebulæ of the milky way in brilliancy: "and, as" says Sir William Herschel, "this starry bed—the milky "way—is not of equal breadth, or lustre, in every "part, nor runs in one straight direction, but is "curved, and even divided into two streams "along a very large portion of it, so, the greatest "variety is discernable in the stratas, and clusters, "of those other nebulæ."

The most remarkable among these astonishing nebulæ, appear to be a very broad, and much more remote milky zone, which crosses the nebulæ of our own milky way, very nearly at right angles. This recently discovered zone, is peculiarly splendid, where it intersects the constellations of the Great Bear, Corona Berenice, and Virgo.

In the year 1784, Messier computed 18 distinct nebulæ, thus resolvable into stars. Herschel's superior glasses soon added 36 to that number: and optical improvements have already augmented it to some hundreds. "These resolvable nebulæ, being," says Sir W. Herschel, "of every magnitude and "form, are found consisting of NUMEROUS CLUS- "TERS OF STARS; and the finer the glasses, the "more generally resolvable, the nebulæ are "found."

To obtain a faint conception of this magnificence, we must endeavour to comprehend the signification of the term "Cluster of Stars." Sir John Herschel, who has devoted peculiar attention to this branch of astronomy, speaking of the clusters of stars, whereof resolvable nebulæ are formed, says, "To attempt to count the stars "in one of these globular clusters, would be a vain "task: they are not to be reckoned by hundreds; "and on a rough computation it appears, that many "clusters of this description, must contain 10, or 20 "thousand stars, compacted, and *wedged together* "in a round space, whose AREA IS NOT MORE "THAN A TENTH PART OF THAT, *covered by the* "*Moon:* so that its centre, where the stars are "seen projected on each other, is one blaze of "light." These clusters, when very rich in stars, are found always either round, or oval in form, with their greatest brilliancy condensed towards their centre:—those of irregular form, and less definite outlines, are generally speaking, less rich in stars, especially towards the centre. In some clusters, the stars are nearly all the same,—in others, extremely various,—and in many, a very red star, occupies a conspicuous station. Sir Wm. Herschel considered, that these latter ill-defined clusters, "are only progressing towards final condensation;" that is, he conceives such groups, "as "approaching by their mutual attraction, and as"sembling themselves from all the surrounding "regions, for ultimate globular configuration, under "laws, evidently in gradual operation, but the "*actuating principle* of which, is yet impervious "to our knowledge."

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Nothing perhaps, may better bring the infinitude of creation HOME *to our perceptions*, than the reflection, that from every remote part of space, our own glorious Sun appears but as one, among the tens of thousand *other stars*, crowded into SOME ONE PARTICULAR CLUSTER: multitudes from among our stupendous surrounding constellations, *forming, together with our Sun*, ITS COMPONENT PARTS!—And yet, such is the infinity of space, that this assemblage of hosts,—hosts, dispersed as they are, throughout both our hemispheres,—hosts, to finite apprehension, forming an *universe within themselves;* appear, from remote regions, *but* as the *compressed particles of an area*, comprising" (to use the words of Sir John Herschel) "not more, *than one-tenth part* of *that*, covered by the moon."

Hence we find, that the visible creation of God, forms one astounding assemblage of system crowning system, every where abounding. Since immense as is the relative distance of every Sun (with *its* attendant planets) from all other Suns (with *their* respective systems) yet in fact, that there is no SOLITARY *solar magnificence.* Amidst innumerable hosts, *every Sun* appertains to *his own express cluster of Suns*,—maintaining his own relative circulating relations with the other Suns, throughout his own cluster:—these innumerable clusters of suns, again enrolling their mighty selves, into the still grander circulating mediums, of multitudinous shoals of Suns:—and again, those very shoals—each, of an immensity surpassing finite capacity—those very shoals of Suns, classing their awful selves, into the still more wonderful circulating mediums, of multiple *stratas*:—and these, *again*, with still *onward and onward progressive* majesty of classification, into resolvable *nebulæ;* until infinity, unfolds before creative wisdom, and the universe,—the UNIVERSE ITSELF, in the fulness of its infinitude, and the plenitude of its unity, revolves around the awful centre of creation!

Hence, the *oscillatory mutability* of all things, save of the SOLE IMMUTABLE SUSTAINER;—

"HIMSELF, uncaused,—of all, the CAUSE,
Who e'en to Chaos,—gave a birth!![*]"

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[*] Manuscript poems of Frances Barbara Burton.

## PORTION II.—OF CLASS THE FOURTH.

*Nebulæ, occupying regions so infinitely remote, as only to be visible through powerful glasses, and that, only in the fashion of light clouds, or vapours.*

THE number of these, progressively *decreases*, according to the *increasing* excellence of glasses. Many of these nebulæ, have been lately resolved into distinct stars by the power of correspondently superior glasses, which were considered previously, beyond any magnifying power; and from further optical improvements, the same progressive result may be anticipated in other more remote *oval,* or *round* nebulæ; since all resolvable clusters, have hitherto been proved to be *such.* "The conclusion being obvious," as says Sir John Herschel, "that "those nebulæ which the most powerful glasses, "at present employed, can barely render resolvable, would be *completely resolved,* by a further "increase of instrumental force."

Annular nebulæ, present extraordinary phenomena. A remarkable one is to be seen in Lyra;

it is very sharply defined, the internal opening, occupying about half its diameter. Another of these annular nebulæ is singularly striking; it consists of a nebulous ring, split through half its circumference, and the portions separated at an angle of 45 degrees.[*] This annular nebulæ bears so strong a similitude to that of our milky way, that it suggested the idea to Sir John Herschel, of "a brother system; bearing a real physical resemblance, and strong analogy of structure, to our own."

No fewer than two thousand nebulæ, with clusters of stars, were observed,—and their places computed, by Sir William Herschel. Six or seven hundred nebulæ have already been observed in the southern hemisphere. The Magellanic clouds, are the most remarkable of these.

Grand, are the astronomical developments to be anticipated from the scientific researches of Sir John Herschel in the southern hemisphere, during his present residence in Africa, in consequence of the clearness of the atmosphere, the magnificence of his apparatus, and above all, the magnitude of his own intellect.

In the mean while, we will hazard a few brief remarks on the nature of the regions of nebulosity, by way of conclusion to this astronomical sketch.

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[*] A space, at that infinite remoteness, *immeasurable by human computation*:—since, even at the comparatively minute angular divergence from our Sun, exhibited by our celestial ecliptical circumference, 45 degrees would be found subtended into a distance of 74 millions 613,000 miles.

# THE REGIONS OF NEBULOSITY.

AMONG the multiplicity of surrounding objects either too vast or too minute, for unassisted perception, the component particles of nebulosity, merit attention. Though excessive rarity (or minuteness) places these particles beyond any term efficiently expressive of smallness,—yet each of them possesses a determinate bulk,—and is allied by definite angular construction, to a specific class. The countless varieties, both in form and substance of these particles, exhibit a diversity in creative operation, amounting to infinite; while the harmonious uniformity of its designs, is equally apparent from the fact that, how much soever different species of nebulous particles vary in other particulars, yet all correspond *in possessing affinity towards their own specific class.* The classification of each particle, may therefore be held as determined by its specific angular construction, and its rotatory action, by the modification, either of the electric or magnetic effluvia, to which the polarity of that construction bears affinity. Here it may not be unappropriate to remark, that the magnetic principle seems an agent more powerful in action, and wider in scope, than the electric. The magnetic fluid appears constantly flowing along the earth, from or towards, one or other of the two poles, with the same oscillatory rotation, attending all the operations of nature;—and the electric fluid, appears correspondingly flowing from the Sun towards the Earth, and from the Earth towards the Sun, in like oscillatory *rotation*, either at direct, or oblique angles, to the course of the magnetic fluid; that is, at angular directions towards it, of every magnitude, as determined by the position of the Earth, towards the Sun, at any given moment. Hence, the electric effluvia, may be considered a grand operative medium of the Sun amongst the planets of his system; and the magnetic effluvia, an important portion of the all-pervading principle, everywhere generated, and *diffused in universal oscillatory rotation;* but, whose action upon the Earth's planet, is determined by the influence of her two polar stars. Every planet, therefore, throughout every system, while propelled and upheld, through the electric agency of its particular Sun, may be presumed as connected with,—or rather,—as entertwined amongst the almighty mechanism of the universe, through the magnetic instrumentallity of its polar stars. We therefore perceive, that celestial bodies, so far from wandering in space unconnected or unsustained, are knit together at every infinitesimal angle, by intersectional gaseous mediums, forming a mechanism more consolidated in construction, and precise in evolution than can enter the imagination of mere human artificers!

As in these instances, *minuteness of operation precludes unassisted human inspection*, so, if we advert to an *aggregate mass of nebulous particles*, efficient to the development of a body of Jupiter's bulk,—a body exceeding ninety thousand miles in diameter,—we shall find ourselves equally lost amidst immensity! But if, for an instant we expand our faculties towards the consideration, that every component particle of this enormous bulk, *possesses its appropriate affinity towards some definitively propelling modification or other*, either of electric or magnetic polarity, (according to the specific angular construction of each particle), we shall cease wondering at the rapidity of orbicular rotation, maintained by bodies of like magnitude.

The magnitude of the regions of nebulosity, probably *comprehends infinitude*, although merely the more condensed portions of it, are visible; and that, only with the highest magnifying powers. The enormous extent of some of these regions, exceeds calculation.

Grand magazines of future systems, and yet undefined stratas of countless Suns, they present to human feebleness, astounding views of creative magnificence;—their multiplicity, corresponding to their magnitude. Sir William Herschel calculated, that 52 masses of them,—never observed until his magnifiers displayed them,—absolutely extended 152 square degrees.

He thus describes the general telescopic appearance of one of these nebulæ.

" Extreme faint branching nebulosity; its white-
" ness, entirely of the milky kind, and brighter in
" three or four places, than in the rest; the stars
" of the 'milky way,' scattered over it, in the same
" manner as over the rest of the heavens; its ex-
" tent in the parallel, nearly one degree and a half,
" and in the meridian direction, 52 minutes."

An attempt shall here be hazarded, towards an illustration of the various telescopic appearances, of *progressive apparent stages*, of nebulosity—from its primary diffusive state, (as above) to its ultimate VITALITY of CONDENSATION.

Comparatively smaller detached portions of nebulosity, receive the name of nebulæ. Nebulæ may be classed into eight progressive stages from their first condensation:—namely,

1st. *Milky Nebulæ.*—These nebulæ are of every form and magnitude,—with ill-defined extremities, and of one general faint whiteness.

2nd. *Milky Nebulæ, with condensation.*—These unshapen masses of nebulous matter, are of every form and magnitude;—some, very long,—some, very narrow,—some, very round, &c. These may be considered, as evincing primary exertions of the *condensing properties* necessary to ultimate vitality; but with such faint indications of *central attractive matter*, as require ages, to attain arrangement of form. MILLIONS OF YEARS in such operations, being as *moments*.

The round nebulæ in Orion, for example, instead of being uniformly white, evinces more *condensed states of nebulosity in some places*, than in others; —as though it were either more compressed, or deeper *in those parts*, than in the surrounding ones. This remarkable nebulæ, engaged Sir William Herschel in a series of observations for 37 years; namely, from 1774 to 1811. He found in the year 1774, the form of this nebulæ already much changed from what it was as given by Huygens, in his Systema Saternium. "A change," he observes, "which "clearly proved, that its nebulous matter has a "tendency to *contract*, or *concentrate* itself into a "spherical body, for its ultimate destination."

3rd. *Nebulæ, which are gradually brighter in the middle.*—These nebulæ plainly evince the *gravitation principle*, in a more advanced state towards condensation, than in the former stages.

4th. *Cometic Nebulæ.*—These nebulæ "exhibit "so strong a resemblance to small telescopic co- "mets," says Sir W. Herschel, "as suggests the "idea, that some comets, may be in fact, highly "*condensed* nebulæ."

5th. *Nebulæ suddenly much brighter in the middle.*—In these nebulæ, *consolidation* seems approaching to a nucleus.

6th. *Nebulæ with distinct nucleuses.*—In this stage, the condensation appears still further progressed; the nucleuses here, being surrounded by a highly rarefied nebulosity, which, though *not yet condensed*, appears enveloping these nebulæ in a *widely extending atmosphere*.

7th. *Round Nebulæ, nearly uniformly bright.*—These nebulæ, appear *drawing towards final condensation*, from the uniform brightness observed throughout them.

In a course of gradual nebulous condensation, a time must arrive, when nebulous matter can receive no further compression; having attained the utmost hardness appertaining to it, as a consolidated mass.

8th. *Planetary Nebulæ.*—In this stage, the principle of condensation seems fully developed; exhibiting objects of distinct resemblance to planets, but still, with the attendant haziness, appertaining to their nebulous origin.

" Planetary nebulæ," says Sir John Herschel, " are very extraordinary objects, with round, or " slightly oval discs; in some sharply terminated, " in others a little hazy at the borders; and of a " light, only very little mottled, which in some of " them, approaches in vividness, to *that* of actual " planets. Whatever be their nature, they must " be of enormous magnitude. One of them, is to " be found near Aquarii, with an apparent diameter " of about 20 seconds. Another, in the constel-" lation Andromeda, presents a visible disc of 12 " seconds, perfectly defined and round. Granting " these objects to be equally distant from us, with " the stars, their real dimensions must be such, as " would fill, on the lowest computation, THE " WHOLE ORBIT OF URANUS" (or Herschel).

Nebulæ, are distributed even more irregularly than stars. In some places, "they are so crowded," says a popular writer, "as hardly to allow *one*, to "pass through the field of the telescope, before "*another* appears; while in other parts, hours "elapse without a single nebulæ occurring. They "are most abundant, in that remote zone which "crosses the milky way of our nearer regions, at "right angles; especially on the constellations, "Virgo, Coma Berenices, and the Great Bear, "where they are to be found in multitudes." Sir William Herschel often contemplated, in close vicinity, double and treble nebulæ, variously arranged:—"Large ones," says he, "with small "ones, seeming like attendants; narrow, but very "much extended lucid nebulæ, or bright dashes. "Some, of the shape of a fan, resembling an electric brush, issuing from a lucid point."

No idea can be formed of the original bulk of their nebulous matter, from the size of any nebulæ as seen at present; "but, if for the sake of computation it be admitted," says Sir William, "that "the nebulosity, when it was in a state of diffusion, took up a space of 10 minutes in every "cubical direction of its expansion, then, as we "now see it collected into a globular compass of "less than one minute, it must of course, be 19 "hundred times *denser*, than it was in its original "state. This proportion of density, is more than "double that of water, to air."

A long series of minute observations led Sir William Herschel therefore to the conclusion, "that,

" those nebulæ, already in a state of compression, " may be still further compressed, so as ultimately, " to become stars:" and when the immensity of nebulosity is considered, requisite to fill 10 minutes cubical space, so, as to be seen at the distance from us, of a star of the eighth or ninth magnitude, and is properly compared with the *very small angle our Sun would subtend*, at the same distance, no degree of nebulous rarity affords an objection, to the solidity required for the construction of a body of equal magnitude, with our Sun.

A circumstance which allies very compressed nebulæ to the character of *well-known celestial bodies*, is, that most, if not all of them, *turn on their axis;* and what is still more remarkable, is, that the largest seven of the ten *planetary nebulæ*, are *not perfectly round*, but a little oval.

If it be asked, whence originated the actual distribution of nebulous matter into Suns, and their revolving planets,—that is, what *primeval*[*] *organization* developed this diversified universe of worlds,—the question as yet is only answerable by conjectures. Some, conceiving the respective *Sun* of each system, as primarily created,—and whence their revolving planets, were subsequently projected.—Some, supposing the small globe of the Earth, first to have started into existence, and the Sun afterwards, as an appendage;—with various other hypotheses.—Some, plausible to mundane blindness, but all, perhaps, equally fallacious.—

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[*] Primeval.—Originative.

Probably, the subject lies beyond the present scale of man's perceptions. It was but yesterday, that as a race,—optics demonstrated to him, the UNIVERSALITY of the *vital principle*, invigorating alike, the microscopic inhabitants of a drop of water, and the telescopic wonders of nebulæ.—Nature's volume is only *unclasped before him:* can he expect the first page should unravel its mysteries?

We may nevertheless already hazard remarking, that the more we expand our ideas, relative to the grandeur of creative operation,—and its consequent universality, both as to extent and duration, —the less we shall degrade it. It appears therefore more consonant both to recent discoveries in regions of nebulosity, and to the all-pervading nature of Omnipotence, to presume, that so far from any single planet having been formed before all others, or even any single Sun, having been primarily irradiated, the organization of celestial bodies may have been effected by the *universallity of that rotatory energy*, constituting their sustaining agency.

In accordance with the universallity of this principle, myriad infinitesimal affluxes may rationally be supposed rotatorily emanating in every direction, from regions of nebulosity. These infinitesimals, may with equal rationality, be presumed organically and rotatorily aggregating into manifold classes of nebulous particles. The multitude of these classes, corresponding to the activity of action in the polaric affinities, upon the inherent combinations of these infinitesimals:—the reorganizations thereby produced, being in conformity with the general mechanism of the universe; which, everywhere appears acting, through the rotatory organization and disorganization, of its constituent portions. Here we must observe, that however impalpable to human unassisted perception, single nebulous particles may be, yet that the reorganization and combination of various affluxial infinitesimals, appear necessary to the formation of one such nebulous particle:—and further, that such seems the probable complexity, as well as minuteness of organization, in those very infinitesimals, that each of them may be capable of subdivision into properties, as essentially diversified, according to the apprehension of beings of higher orders, as are the component parts of an elixir, to human faculties.

The intensity with which this complexity must be amalgamated, appears another striking feature in the agency of these infinitesimals:—and probably the nice equipoise between the primeval tenacity of this organic amalgamation, and the activity of the developing laws of polaric affinities, forms the keystone to a variety of nature's phenomena.

Nature's laws ever act analogously;—and the more elaborate the condensation of the creative and regenerative properties within these infinitesimals, the more stupendous must be the *reaction of their development.* The intensity therefore of this amalgamation,—an intensity amounting to infinite, and apparently marked with the *spiral delineation* of all nature's organizations,—this intensity of amalgamation, may be assumed of vital instrumentallity in the diffusion of solar and planetary rotatory influences,—whether that diffusion be of a creative, or a regenerative nature.

Infinity of minuteness, lies as far beyond comprehension, as infinity of greatness:—but our conceptions must aim at conforming themselves, in some degree, to the marvels of both, in treating of the regions of nebulosity;—constituting, as do those regions, emporiums of nature's alchemy,—focuses of her operations,—and scattered everywhere around, as they are, with her accustomed profusion.—Emporiums,—whence issue we may perceive, the creative—the regenerative affluxes of surrounding space, in combinations so minute,—so intricate,—that eternity only, might suffice for developing the wonders of a single atom! These, and such as these,—form our present contemplations.—Laboratories,—of grandeur unfathomable even by *thought*:—and effluvias,—veiling themselves from computation, through infinity of rarefaction!

Human faculties gladly shelter themselves after such contemplations, within objects of comparative familiarity.—These,—they find in *nebulous particles.* A universe of affluxes, illudes unassisted human perception;—but the gradual combination of a detached portion into nebulous particles, through rotatory and polaric action, brings *that portion*, palpably before the senses.

We therefore rationally may presume, infinitesimal affluxes, primarily, to have been exhaled from regions of nebulosity;—and subsequently, to have been aggregated into nebulous particles of numberless diversified polarities and affinities, during a sequence of many ages:—and, we may equally suppose, the aggregation of those nebulous particles into detached masses—denominated nebulæ—to have taken place, through like rotatory and polaric action, in the course of periods of like immensity: —the very heterogeneousness of the original MATERIALS, serving to display the harmoniousness of creative design, as progressively developed in the sequel of *still farther myriads of ages!*

And here, conjecture appears terminated. The observation of nearly a century with highly wrought glasses, offers the conclusion, that every particle of every specific nebulæ, from impulses analogous to the foregoing,—(that is, by like rotatory action, and from like generally decomposing and recomposing polaric affinities)—that every particle, classes itself amidst those of relative rarity or polarity, although on a scale of proportionate grandeur. For we must remember, it is a Nebulæ we are now contemplating:—a Nebulæ, wherein the denser particles are aggregating,—not into fresh atoms,—but into august centres,—or Suns,—of future systems;—and wherein the particles of more rarefied tenuity, or external position, are systematically classing themselves into Orbs, proportioned to their respective species, or polarities: —until assemblages of Globes present themselves, of the diversified magnitudes, densities, and aspects of those composing our system:—and in process of time,—that is, in the course of myriads of ages, the nebulosity of one entire nebulæ expands into the illumination of *its own multitudinous clusters of Suns;* each Sun, throughout each cluster, having progressively become encircled by his own express system of planets, and their revolving Moons. The inherent all propelling rotatory principle, appertaining to each constituent particle of each individual globe, analogously developing itself, not merely in propelling action towards each distinct planet,—but, towards those very Suns themselves. Hence, every Sun of every specific cluster,—himself rotatorily propelled, and rotatorily propelling others, splendidly illustrating the analogy between the revolutions of his own dependant planets around his own immediate orb,—and those on the more magnificent scale, whereby his effulgent self,—and the other Suns of his cluster,—revolve around *that* cluster's common centre.

Finally this primordial principle, UNIVERSAL ROTATION—exhibiting itself *crowned with the majesty of infinitude,*—as EVERY CLUSTER of the countless clusters pervading space, marshalled within its appropriate STRATA OF SUNS,—continues revolving around *the centre of the universe*, during cycles, the myriads of whose enumeration, outstretches calculation!

But whence originated this mysterious agency, whence generated, what is the ESSENCE of the rotatory universality, may not be for human apprehension! Everywhere, its vitality is felt, is beheld; even in our minutest organic functions, even amidst the decompositions of death: but its NATURE, lies impervious to sense. Man, can only speak of its mechanical processes. None can impel, none can illude, none can restrain it; and everywhere surrounding, and actuating, and sustaining, it bears the stamp of Omniscient Omnipotence, which shrouds creative might from mortal investigation!*

Previous to Sir John Herschel's departure for the Cape, he illustrated the positions of 2,500 clusters and nebulæ; 2,000 of which, owe their discovery to his father, and the remaining 500, to his own observations.

The researches of this illustrious father and son, have thus, opened the sublimest of all subjects to human contemplation:—namely, *a ceaseless series of solar systems, calling forth by the Divine energy from the original matter of physical nature.* Astronomical observations will henceforward be directed, with reference to the laws of creation itself, towards some of the positive facts, in constant and progressive operation, amidst the regions of nebulosity; and the resplendent benificence of the Creator, will be more and more manifested, as the universality of his operations becomes more and more developed. Through the scientific expansion of futurity, some thousands of years hence, calculations on the consolidation of a starry stratum, may be hazarded on premises as precise, as those now employed on the growth of a cedar tree; both, equally the workmanship, and under the superintendence, of the same power; since the development of a petal or of a planet, is alike dependent upon, and demonstrative of OMNIPOTENCE!

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* The foregoing hypothesis offers no contradiction to the biblical records of creation: the Mosaic account therein, exclusively confining itself to the creation of this particular world—or planet—the Earth.

We have here approached boundaries, impervious to the ignorance of former ages; and, at the infinity of whose remoteness from our solar system, man's faculties stand appalled; yet so far from being those of limitation, demonstrated by the encreasing excellence of present magnifiers, as leading still onwards and onwards, amidst fresh regions of infinitude, and fresh displays of creative vitality. Displays, not merely of Sun upon Sun, in stupendous rivalry, but embracing regions, the smallest conception of whose immensity, demands the entire abstraction of human intellect. Regions, wherein the immutability of GOD, reveals itself in an eternity of primordial diffusion; wherein the faintest object discernable by man, comprises stratas of Suns; and the minutest operation, the formation of worlds!

THE END.

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# GLOSSARY.

**Affluxes.**—Infinitely numerous and subtile mediums, whose infinitely diversified properties, and in various properties, every where pervade all space.

**Antipodes.**—A point directly opposite any given point on the Earth's surface, constitutes a terrestrial antipodes:—for example, the position of New Zealand on the Earth's planet, is the Antipodes of that of England.—In like manner, a point directly opposite any given point within the circle everywhere surrounding us of the heavens, constitutes a celestial Antipodes:—as for example, the Antipodes in the heavens of the constellations of the Little Bear, is that of the Cross.—The star in the Cross, therefore, the most precisely answering our present north polar star in the Little Bear, is the present south polar star: and the celestial antipodes of the star Lyra, in the constellation of the Harp, being that of a star in the Great Dog, it follows, that when Lyra becomes the Earth's north polar star, the star in the Great Dog, the most precisely the Antipodes of Lyra will necessarily constitute the south polar star of those remote generations.*

**Aphelion.**—The remotest point from the Sun in the course of a celestial body around him.

**Atmosphere.**—Inumerable condensations of affluxes of various properties, and in various proportions, one of which, surrounds each celestial body; becoming thence a generative, diffusive, or recipient medium of life, light, heat, and motion, according to the specific nature, or position in space, of the body it surrounds.

**Axis.**—The line supposed to pass through the centre of a body, and round which it turns.

**Constellation.**—Groups of apparently neighbouring stars, classed together under one name.

**Cycle.**—A period comprising the series of phenomena attending one revolution of any celestial body, to which the term is affixed. When used alone, it indicates the like series of phenomena attending one revolution of our own Sun around the centre of the universe.

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* *This future south polar star of our Earth is rather above the heel in the Great Dog.*

**Declination.**—The distance of any of the celestial bodies either north or south from the equator, as reckoned by degrees.

**Degree** *(Celestial.)*—The 360th part of a circle and the 30th part of a zodiacal sign.

**Diameter.**—A line passing through the centre of a circle, and dividing it into two equal parts.

**Disc.**—The body of one of our solar celestial orbs, as it appears to us.

**Diverging.**—Going further and further asunder.

**Ecliptic** *(Celestial.)*—The great circle comprising the path of the planets around the Sun.

**Ecliptic** *(Terrestrial.)*—The line on the Earth's surface on which this planet turns on its axis.

**Firmament.**—The celestial expanse everywhere surrounding the Earth and within which we behold all celestial bodies.

**Hemisphere.**—The half of a circle or sphere.

**Horizon.**—The great circle that divides the world into two parts or hemispheres.

**Hypothesis.**—A principle taken for granted, whence certain conclusions may be drawn.

**Inclination.**—The tendency in one line or path towards another, so as to accomplish its crossing point contact. The inclination of a celestial body towards the ecliptic, means the distance at any moment of that body's path from the ecliptic,

**Infinitesimals.**—Quantities of smallness that is infinite.

**Meridian.**—A circle of a sphere passing from north to south, under every part of which it is noon at the same time.

**Nadir.**—That point in the heavens opposite to the zenith, and directly under our feet.

**Nebulæ.**—Cloudy, hazy, dark stars, or other distant celestial appearances.

**Nodes.**—Points of intersection by any secondary planet with the ecliptic of its primary. In reference to the crossing points of the terrestrial ecliptic by the Moon, they are denominated nodes:—but in reference to the crossing points of the celestial ecliptic by the planets, they are denominated the equinoctial crossing points. In both cases, probably they determine the revolutions of the seasons of all secondary planets.

**Nuclus.**—The condensed portions of any nebulaic or cometic appearances.

**Orbit.**—The path of a celestial body around its primary.

**Oscillation.**—A regular vibratory motion.

**Perihelion.**—The nearest point to the Sun in the course of any celestial body around him.

**Phases.**—Changes in appearance, towards us, of certain solar celestial bodies, consequent to the relative alteration in position of our respective revolution.

**Plane on its Axis.**—The line supposed to pass through the centre of a body, and round which it turns.

**Primordial.**—Originative.

**Rotation.**—The regular revolution of a body around itself.

**Satellites.**—The scientific appellation of Moons.

**Signs of the Zodiac.**—Those groups of apparently neighbouring stars, lying within nine degrees on either side of the celestial ecliptic, and each group of which, is classed under one name.

**Spiral Course.**—A curved line, winding round nearly in a circle, but not meeting to run again into itself;—each winding continuing onwards, at a proportionate distance from the last.

**Sphere.**—A circular body of one regular surface, whereof all lines drawn from the centre to that surface are equal.

**Spheroid.**—A body resembling a sphere, but whereof one of the diameters is longer than the other.

**Year** *(Celestial.)*—The period of one revolution of the stars around their common centre.

**Year** *(Solar.)*—The period to each specific planet, which comprises one of that planet's revolutions around the Sun.

The diversity exhibited in the periods of these revolutions, strikingly demonstrates the relative length of existence, appertaining to the inhabitants of each specific planet: since the *duration of life in every planet* necessarily must be proportioned *to the periods between its seed and harvest times:* or whence, except through miraculous interventions inconsistent with omniscient immutability, might originate knowledge of the successive influences of its seasons, adequate to the obtaining by its inabitants, of the productions suitable to their natures?—For example,—88 of our days comprise one of Mercury's years;—the rapidity of growth in that ardent climate, naturally crowning with harvests the seed times of his inhabitants, after the brief interval of 44 of our days. Consequently, in the course of six only, of our years, one of Mercury's inhabitants attains the age of 24 of Mercury's years, with all the attendant experience of 24 successions of his seasons.—Hence the inference of probable shortness of existence, in Mercury.

On the other hand, the period of 288 *of our years* is requisite to complete a term of 24 of Jupiter's years;—and *six of our years,* intervene between his seed and harvest times. Consequently, it requires a period of these 288 of our years, for one of his inhabitants to attain the age of 24 of Jupiter's years, with the like attendant experience of 24 of that planet's succession of seasons. Hence, the inference of probable length of existence, in Jupiter.

How therefore, may we justly appreciate *duration of existence in Herschel,*—the intervening periods between whose seed times and harvest times, *amount to* 44 *of our years*:—and consequently, the adequate experience respecting whose seasons, to be obtained by an inhabitant aged four-and-twenty of Herschel's years, requiring 2,016 of our earthly ones, for its developement ! !

ZENITH.—The point of the heavens perpendicularly over our head.

ZONE.—A division between any two parallel portions of space.

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